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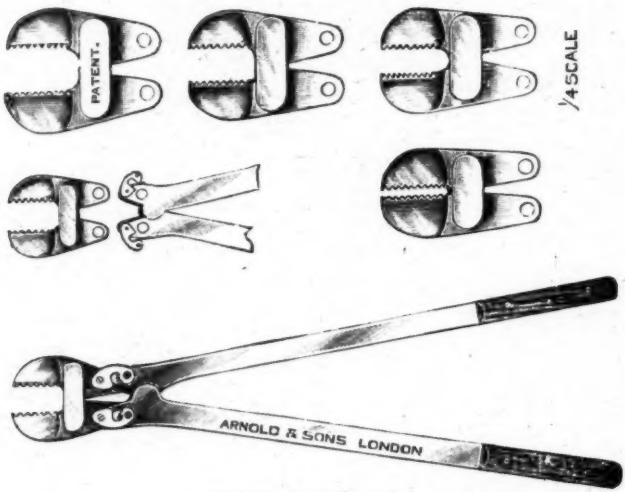

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THE

VETERINARY JOURNAL

JUNE, 1911.

Editorial.

THE ROYAL COLLEGE OF VETERINARY SURGEONS.

THERE is no gainsaying that the veterinary profession in the British Isles is at present passing through a very critical stage of its existence, and it is very difficult to see what is in store for us. The advent and steady improvement of the methods of motor traction have been very serious for practitioners in large towns, as may be gathered from the fact that in one practice in London with which we are acquainted well over two thousand horses have been removed from the contract list, having been replaced by motors or driven from the streets by competition with trams, motor omnibuses, and taxi-cabs. However, we are not pessimistic as to the future if only the members of the profession will waken up and see what can be done to minimise the ill effects of outside competition. But we would suggest to our readers, and emphasize the fact, that remedy does not lie in the cut-throat system of competition within our own ranks, an example of which has recently been ventilated in one of our weekly contemporaries. "As one door closes another opens" is an oft repeated axiom, and it is not without application in our own case. In agricultural districts the veterinarian must hold his sway for long years to come, and in towns the increasing fondness on the part of the general public for small pets, and the rising demand for unques-

tionably wholesome meat and milk, are matters which we should do our best to foster.

Then there is that most important matter of the protection of our rights and privileges which is the function of the Royal College of Veterinary Surgeons, and intimately bound with which is the protection of the community against fraudulent quackery. But this involves great expense, and the income of the Royal College of Veterinary Surgeons is rapidly diminishing. This is brought home to us very clearly by the report of the Council for the year 1910-11, during which the expenses have exceeded the income by practically £300. This is a state of affairs that cannot go on for long, and it is very fortunate indeed that in former times we have had business-like men at the head of affairs to husband the resources for these rainy days. Some of the complaints brought forward involve considerable expense, while it is remarkable how easy it is to bring some irregularities to an end. An instance of the latter came under our personal notice only last summer when we were visiting a well-known East coast watering place, where the son of a deceased "Existing Practitioner" was practising under his late father's name. We were informed by the local Member of the Royal College of Veterinary Surgeons that he had complained to the Royal College, who informed him that direct evidence was necessary, and requested him to send either a bill head or circular, or photograph of the brass plate. Our informant felt aggrieved, and thought the Royal College of Veterinary Surgeons should have investigated and procured the necessary evidence themselves. We pointed out to him that if the Council instituted primary investigations in the case of every complaint they would be throwing away a considerable amount of money in conducting wild goose chases. We might also say in passing that this gentleman *was* moreover, an objector to the annual fee proposal. Many of us know the type of man who wants a lot for nothing and thinks he has a right to it! We are glad to say he is now a supporter of the Bill since the true state of affairs has been explained to him. However, we proceeded to take the necessary photograph of an offending door-plate, and must have been observed in the process, for on the following day it had been removed. Unfortunately all

offences are not so easily obliterated. If we are desirous of protection in this and other respects we must be prepared to contribute towards the expense, and we are glad to know that the opposition to the compulsory annual fee has dwindled to an insignificant minority.

With regard to the Bill, it has been read the first time and was to have been brought forward for a second reading on the 26th ult. We regret that it was crowded out on that occasion and was ordered to be brought up again on the 16th inst., when we trust it will meet with a better fate.

Another matter of some importance is referred to in the annual report, with reference to the use of the College Arms and Crest. Contrary to the view generally accepted by practitioners, Members of the College are not entitled to use the Armorial Bearings on stationery without paying the duty. This was an indulgence granted by the Board of Inland Revenue, but could not be claimed as a right, and certain County Councils are now claiming the payment of the statutory licence of one guinea per annum.

The Annual Meeting this year is to be held on June 7, at 12 noon, and in the evening an informal dinner is to take place at the Trocadero at 7 p.m. Some years the meeting has clashed with that classic event The Derby, but it does not do so this year, and we trust a large number will attend both functions, and show their enthusiam for matters professional and social. When things were going well the old British policy of *laissez faire*, was perhaps not so objectionable, but in these times it is essential that we should work together for the common good, and show our belief in our motto *Vis unita fortior.*

General Articles.

THE CLINICAL ASPECT OF JOHNE'S DISEASE AND THE AVIAN TUBERCULIN TEST.*

By G. P. MALE, M.R.C.V.S.

indexed B. A. I. *Reading.*

During the last few years the pathology and bacteriology of this specific bacterial enteritis has been fairly well made out, and therefore I will not dwell upon it now. As is well-known to you all the causal organism is a small, acid-fast bacillus, closely resembling the tubercle bacillus and having practically the same staining reactions and morphological characters. It is known all over Europe, and appears to affect most of the ruminating animals, as cases are recorded in the sheep, buffalo, and deer, as well as bovines, in which, of course, it is most common. The period of incubation is undoubtedly a long one, and may extend to months or even a year or more, hence the great difficulty of eradicating it from a herd. Probably the only natural method of infection is ingestion, the bacilli being taken in by the mouth with contaminated food. It appears also to be a purely contagious disease, though it does not spread with any rapidity. The disease has been described chiefly in connection with Jersey cattle, but all bovines are susceptible to it, and I have met it in nearly all breeds. Jerseys, however, seem to be more prone to it than any other. The disease is most common in adult cattle, though I have met it in young Jerseys between one and two years old, and in one outbreak three Devon beasts about two years three months were affected at the same time in a herd of ten. The practitioner's attention is not usually called to the disease until diarrhœa has become a marked symptom, but if the animal has been carefully observed there is usually some slight loss of condition and unthriftiness apparent for some time previous without any apparent cause for it. Diarrhœa usually sets

*A paper read before the Royal Counties Veterinary Medical Association.

in suddenly, often after parturition, or as a complication to some other diseased condition. In other cases the onset of diarrhœa is less rapid and the condition assumes a more chronic form. In these latter cases there is no rise in temperature, but in what might be called the acute cases I have sometimes found a temperature ranging from 103° to 105°, lasting for some days, the appetite also being in abeyance. Here the wasting is very rapid and the animal is soon reduced to a skeleton. The more chronic cases gradually get emaciated, but the appetite usually remains good, and even abnormally so, rumination takes place, the eye is bright and pulse normal. This may go on for months till death takes place, which is the invariable rule in all cases where diarrhœa has been a symptom. In some of the chronic cases death may be delayed for many months by careful feeding and astringent medicines, the diarrhœa being held in check. In one in which treatment was adopted the diarrhœa ceased for about a month, only to come on again however with renewed violence. The condition of the fæces is usually fœtid, watery, and contains a number of air bubbles, but as this maintains in other conditions not associated with the Johne's bacillus, it cannot be looked upon as a diagnostic symptom.

Lesions.

The lesions are confined to the intestine and lymphatic glands of the abdomen, but even in these the pathological changes are sometimes not very striking and may easily be overlooked. The commonest situation for distinct lesions is in the posterior end of the small intestine, *i.e.*, the ileum and part of the jejunum; but the anterior part of the large intestine may show marked inflammation and congestion. In advanced cases the lesions are almost characteristic. Even before the ileum is opened it is seen to be distinctly thickened, and if grasped in the hand this thickening can be easily felt. When opened there is seen a marked corrugation of the mucous membrane which is permanent and cannot be effaced by stretching. The surface of the bowel is often inflamed and red, but this is not always so, and sometimes it is quite pale. In other cases the mucous membrane is intensely inflamed, but there is very little thickening or wrinkling. No ulceration is ever observed. The corrugation is sometimes present very

soon after symptoms of diarrhœa are shown. In one case in which a first calving cow was killed a week after diarrhœa commenced, the ileum was distinctly thickened and wrinkled, showing that the condition had been present for some considerable time, although no definite symptom had been shown.

The lymphatic glands may be slightly enlarged and watery. I have several specimens of bowel on view, in some the wrinkling is well marked. In one there is only slight thickening, while in another specimen there was considerable inflammation apparent in the fresh state, but very little wrinkling.

Diagnosis During Life.

This is the most important consideration for the clinician, as he has to decide whether an animal with chronic diarrhœa shall be slaughtered or whether treatment shall be commenced, and if the latter, what success is likely to attend his efforts.

From what has been said before, it can be easily seen that there is nothing characteristic at all about the symptoms that would enable one to distinguish it from diarrhœa due to parasites or other causes, though by weighing up all the history, &c., one can arrive at a fairly safe conclusion in many instances.

The history will usually reveal other cases on the same farm occurring sporadically for perhaps a number of years. Usually only one animal is affected out of a number, and it is generally an adult one. In parasitic gastritis usually a *number of young* animals are affected at the same time. If tuberculosis is present other signs of that condition will be noticed, *e.g.*, cough, and respiratory abnormalities, whereas in Johne's disease there is no cough, and if the ordinary tuberculin test is applied there is no reaction. It has been said that it can be diagnosed by a microscopical examination of the fæces for acid-fast bacilli, but it is only occasionally that one can find these bacilli in sufficient numbers in the fæces to warrant a diagnosis, and then one must be certain that they are not tubercle bacilli. I have tried the method of obtaining bacilli by scraping the wall of the rectum with the finger-nail, spreading on a slide, and examining for the bacilli, but without success. Moreover, failure to find bacilli would prove nothing, as the bacilli are not always present in the rectum. We must therefore look to another agent. Bang (Junr.) discovered that when tuberculin prepared from avian T.B. was injected into

an affected animal, a more or less decided reaction occurred. This method I have employed with avian tuberculin, kindly given me by Mr. Stockman, with the following results:—

Herd 1.—Jerseys, consisting of 1 bull, 10 cows, and 8 heifers and calves were tested, and 2 cows and 2 heifers gave the following reactions; the others showed no rise in temperature:—

	Time of Injection	9th hour	12th hour	15th hour
(*a*)	100.4 ...	104 ...	103.2 ...	101
(*b*)	101 ...	102 ...	104 ...	101.4
(*c*)	101 ...	102 ...	104 ...	105
(*d*)	101.4 ...	101.4 ...	103.2 ...	99.2

(*a*) Had diarrhœa at the time of injection, was slaughtered and proved to be affected with Johne's disease. Sir J. McFadyean most kindly confirmed the diagnosis.

(*b*) Was isolated from the herd and some weeks afterwards developed diarrhœa. She was at once slaughtered, and on *post-mortem* examination the characteristic thickening of the bowel wall was seen and a bacteriological examination showed the presence of acid-fast bacilli.

(*c*) Was slaughtered and was found to have the disease.

(*d*) Was afterwards tested with ordinary tuberculin, but gave no reaction. She was slaughtered and the bowel was examined by Mr. Stockman, and although he was unable to find the bacillus in the specimen sent, he gave it as his decided opinion that it was a case of Johne's disease. It may be suggested that perhaps these cows had tuberculosis? This is negatived by *post-mortem* examination and failure to react to the tuberculin test, which had previously been applied to all but the calves. It may be said also that the fact of four reacting and having the disease at *post-mortem* examination does not prove that the others which did *not* react were healthy. Against this there is the fact that there have been no cases for the last twelve months, though previously they were seen every few months.

As I shall show later, although preventive measures were employed and the cattle put on fresh pasture for six months, cases still occurred before the animals were subjected to the test.

Herd 2.—Thirty-two Jerseys of all ages, tested with avian tuberculin last May. Five gave a positive and one I classed as a

doubtful reaction, viz., 26. The temperatures of the reactors are as follows:—

No.	Time of Injection	9th hour	12th hour	15th hour
5	101.2	101	103.8	103.8
8	101	103.2	101.4	101
20	101	104	102.4	102.2
24	101.8	101.8	103.2	104
29	101	101	105	102
26	102	102	103.2	103.6

Unfortunately circumstances did not permit of my proving the correctness of the test, for these animals were sent away from the farm immediately. It is significant, however, that there has not been another case of Johne's disease since, though previously it was common. Also all these animals were distinctly unthrifty and I was able to pick most of them out from a number of the herd two days after the test, although I had not seen them personally before.

Two suspected cases which I tested recently occurring on separate farms where there is no history of previous disease, gave the following reactions:—

No.	Time of Injection	9th hour	12th hour	15th hour	18th hour
(1)	101	101.4	102	101.2	101
(2)	100.2	102	101.2	101	101

In both these cases the small intestines were inflamed and somewhat thickened, but there were no characteristic corrugations as are met in the most typical cases of Johne's disease, although both cows had been affected for several months with profuse and persistent diarrhœa.

The bowels of No. 1 were examined bacteriologically for Johne's bacilli by Sir J. McFadyean, who failed to find any acid-fast bacilli. My assistant, Mr. Dunn, searched most carefully in the second case for bacilli, but without result. This bears out the test, which gave practically a negative result, the rise in temperature being only a slight one in each case.

I might say that both these cows had been previously tested with ordinary tuberculin but gave no reaction.

Failure to find the bacilli does not, of course, prove that these

animals were *not* affected with the disease, but taking the negative result of the test also into consideration it may point to some other irritant as being the cause of the diarrhœa, &c., and if so we may not be right in ascribing every case of persistent chronic diarrhœa and wasting where parasites or tuberculous lesions are not found at *post-mortem* examination, to Johne's disease.

This, I think, should be borne in mind in any legislation that may be forthcoming in this connection.

Treatment.—Several agents have been put forward as cures for this disease, but up to the present I have been unable to find one effectual. In turn I have used all kinds of astringents, antiseptics, and tonics, with no permanent results, although in several cases treatment has been commenced the instant diarrhœa started, and persisted with for considerable periods. Tobacco in the form of balls, copper sulphate solutions, perchloride of iron solutions, nitro-hydrochloric acid, sulphuric acid, &c., have been employed, but undoubtedly I obtained the best results from cyllin given diluted in drachm doses once or twice daily. In several cases the diarrhœa has been held in check for days, and in one case for weeks. Of course the actions of medicines were aided by good concentrated food, warm, comfortable byres, &c.

The conclusion is forced upon me that by the time symptoms of diarrhœa are shown the disease has been present for some considerable time and the bowels are so badly involved that treatment *must* prove quite ineffectual.

I am in hopes, however, that with the avian tuberçulin test the disease will be discovered in its early stages, and then treatment may be commenced with much greater hopes of success.

Preventive measures are rendered most difficult on account of the long incubation period, during which the animals must be voiding large numbers of bacilli, infecting byres, grass land, &c., on which they graze.

No reliable data have as yet, I believe, been collected as to how long the bacilli may live outside the body in a soil.

In one farm I advised that all cattle should be removed from the usual pastures and put on to fresh ground and only horses allowed there for six months, the pasture land and ponds, &c., in the meantime, being dressed with 5 cwt. each of salt and lime. This was carried out, but I regret to say it appeared to have no effect on the occurrence of the disease.

From my present knowledge I can understand this. Probably many animals were already affected, but showed no evidence of it and were carrying the bacilli in their bodies. The only hope, therefore, of eradicating it lies in the test. If all those *reacting* are *isolated*, whether showing symptoms or not, the disease may perhaps be stamped out of a herd. As I indicated, this was done with a Jersey herd last May, and I am glad to say up to the present there has been no recurrence of the disease; but, of course, the time is still short. Until more is known about this condition it is difficult for the State to frame regulations to combat it, but it is now so widespread and works such havoc with our dairy herds that it is to be hoped some measures may be adopted in the near future to prevent affected animals from being exposed and sold in the open markets, and so being a source of infection to others.

TUBERCULIN AS A DIAGNOSTIC AGENT.*

By ARTHUR R. LITTELJOHN, L.R.C.P., M.R.C.V.S., D.P.H.
Assistant Medical Officer, London County Asylum, Hanwell.

Tuberculin was first introduced in 1890 by Koch, who at the time thought he had discovered a curative agent for tuberculous infections. Since then, however, he and many others have brought out modifications of the original tuberculin. Koch's original tuberculin is known as "Old Tuberculin" in contradistinction to "New Tuberculin," which was introduced by him in 1897.

The *Old Tuberculin* he prepared by growing tubercle bacilli in glycerine bouillon for some weeks and then killing them by heat. The broth was finally concentrated and filtered free of bacilli. In minute doses, hypodermically, in a healthy individual it is responsible for no apparent changes, but in a tuberculous subject such an injection causes malaise, marked elevation of temperature, the formation of sloughs on the surface of existing tuberculous glands, and swelling of existing tuberculous glands, &c.

* Read at the Birkenhead Congress, 1910. From the *Journal of the Royal Institute of Public Health.*

The *New Tuberculin* he prepared by growing bacilli as in the preparation of "Old Tuberculin," separating the bacilli, drying them *in vacuo*, and triturating them by machinery. From this powder of tubercle bacilli Koch obtained three varieties of "New Tuberculin":—

(1) T. A. (Alkaline Tuberculin). This is prepared by stirring and shaking the powdered bacilli in a 10 per cent. solution of caustic soda and then filtering.

(2) T. O. (O—ober—upper). After trituration of the cultivated tubercle bacilli they are emulsified in distilled water and the whole centrifugalized. This separates the emulsion into two layers, the upper of which is free from bacilli. This upper layer is drawn off and constitutes T. O.

(3) T. R. (R—residue). In the preparation of T. O. after centrifugalizing and removing the upper liquid, there remains a muddy residue. This residue is collected, dried, triturated, emulsified with distilled water and again centrifugalized. As in the preceding process the emulsion separates into two layers. The lower layer or residue is several times subjected to similar treatment until no residue is left. After each centrifugalization the upper layer is collected, and in the end these layers are all mixed, constituting T. R.

From the foregoing it will be seen that "Old Tuberculin" contains neither bacilli nor remnants of bacilli, but consists solely of the concentrated glycerine broth containing the extra-cellular or excreted toxins of the bacilli. "New Tuberculin," on the other hand, contains none of the excreted toxins, but owes its activity to the intracellular toxins contained in the protoplasm of the bacilli which toxins after destruction of the bacilli are dissolved in the distilled water.

For purposes of diagnosis it is the "Old Tuberculin" that is used, "New Tuberculin" being used for treatment.

The Subcutaneous or General Test.

Man.

In man the administration of "Old Tuberculin" subcutaneously for purposes of diagnosis has been almost entirely given up, owing to the serious constitutional disturbance resulting, and also to the fact that some cases of latent tuberculosis

have, with disastrous results, apparently been restarted in activity.

Method.—In cases of suspected tuberculosis the usual dose is 0.001 c.c. of "Old Tuberculin" for adults, half that dose for children over 5, and quarter that dose for those under 5. This is injected under the skin, usually of the forearm.

Reaction.—If the patient is tuberculous a reaction will follow within forty-eight hours of the injection, and is shown by malaise, constitutional disturbance, and a rise of temperature 1° to 2° F.

Calmette (*Brit. Med. Journ.*, August 28, 1909), discussing the use of the subcutaneous reaction in man, draws attention to the following disadvantages:—

(1) The general febrile reaction produced is accompanied by a congestive reaction of the tuberculous foci, which may result in dangerous diffusion of tubercle bacilli.

(2) It is useless for febrile patients or those with an irregular temperature.

(3) Aggravation of the disease has been rightly or wrongly attributed to the injection. Wolff-Eisner (*Brit. Med. Journ.*, March 13, 1909) states that a positive reaction to Koch's subcutaneous injection indicates tuberculosis not necessarily active, and has been obtained in 50 to 80 per cent. of persons apparently healthy.

Cattle.

In cattle the subcutaneous test is now very widely adopted and is considered by many as an almost infallible test for tuberculosis.

Method.—The usual method adopted is to keep the cattle in the shed, fed on their usual food and protected from draughts. The temperature is taken at least once on the day preceding the test, again at the time of making the test, and at the ninth, twelfth, and fifteenth hour after the injection. They should not be allowed to drink large quantities of water between the sixth and fifteenth hour after injection. The dose is 50 minims of "Old Tuberculin," but may be varied above or below this quantity according to the size of the animal. A clean hypodermic syringe should be used and the whole of the dose should be injected under the skin in some convenient place, such as behind the elbow.

Reaction.—If due aseptic precautions are taken the local reaction is always slight, but Vallée has shown that tuberculous animals slaughtered shortly after the injection of tuberculin invariably show some swelling and congestion at the site of the inoculation. The general reaction is shown by more or less constitutional disturbance and elevation of temperature. Cattle in which the temperature, during the fifteen hours following the injection, rises gradually to 104° F. or more may be classed as tuberculous; those in which the temperature remains under 103° F. may be classed as non-tuberculous; and those in which the maximum temperature is under 104° F., but over 103° F., should be regarded as doubtful and should be retested after a month's interval.

Without the aid of tuberculin a large majority of the cases of tuberculosis in cattle would be overlooked, as it is not till the advanced stages are reached that the disease can be recognized clinically. An animal giving an undoubted thermal and general reaction to a dose of tuberculin hypodermically can safely be said to contain one or more tuberculous lesions in some part of its body. According to Melvin (*Brit. Med. Journ.*, October 24, 1908), out of 23,869 reacting animals slaughtered, 23,585 (98.8 per cent.) showed tuberculous lesions. He holds that properly prepared tuberculin is a very reliable diagnostic, if applied by a competent person, and that unsatisfactory results are due usually to poor tuberculin and ignorance or carelessness on the part of the observer. Arloing (*American Veterinary Review*, November, 1908) also states that in his opinion a positive reaction is certain evidence of the presence of tuberculosis. The absence at the *post mortem* of naked-eye lesions in a reacting animal is no criterion that the test is at fault, as inoculation of test animals has in many cases proved the presence of tubercle bacilli in the organs of the reactor.

In cattle the subcutaneous test does not appear to have the serious disadvantages already mentioned as occurring to man, but it is not, however, free from disadvantages; for instance:—

(1) It cannot be carried out on cattle with a high initial temperature—*i.e.*, over 103° F.

(2) It is not unusual to get numerous uncertain reactions (*i.e.*, the temperature rising to between 103° and 104° F.), in which case a retest is necessary, and for this several weeks'

interval is usually required. Vallée, however, in such cases recommends giving double the dose of tuberculin and taking the temperature two-hourly during the subsequent fifteen hours. He holds that by this means a reaction is obtainable in cattle tested only thirty-six hours previously.

(3) Again, animals repeatedly inoculated with tuberculin acquire a tolerance for it, and though tuberculous will fail to react to the ordinary dose. Unscrupulous owners, in order to defeat the test, have been known to dose the cattle by injecting one or more doses during the day preceding the official test.

(4) The thermal reaction is to a large extent prevented by the administration of antipyretic drugs after the subcutaneous injection. This method has also been adopted by unscrupulous owners for purposes of deceit.

(5) Lastly, animals in advanced stages of tuberculosis frequently fail to give the reaction.

These defects render the "subcutaneous test" not all that is desired, and other methods of "testing" have been tried. None of them, however, have succeeded in replacing the original test, though some of them might with advantage be carried out coincidentally.

Having dealt at some length with the "original or subcutaneous test" we come to the various local reactions that are obtained with tuberculin. Speaking of these Vallée says: "It seems incontestable that the reactions of a tissue under the influence of tuberculin reveal a tuberculous infection of the organism (*Proc. Soc. Cent. de Méd. Vét.*, October 15, 1908).

One of the first local reactions introduced was the conjunctival or ophthalmic reaction of Wolff-Eisner and Calmette

The Conjunctival Test.

This method of obtaining a reaction was in 1907 introduced independently both by Calmette and Wolff-Eisner for the purpose of detecting tuberculosis in man. Wolff-Eisner used a 10 per cent. solution of "Old Tuberculin," but Calmette used a special tuberculin prepared by precipitating "Old Tuberculin" in alcohol, drying it and dissolving it in sterile water or normal saline. By this means he avoided the presence of glycerine and bouillon, which he thought might act as an irritant. His fears, however, were unfounded, and both forms of tuberculin are now in use for this reaction. Calmette recommends a 1 per cent.

solution, but more recent investigators recommend half this strength.

Man.

Method.—The lower eyelid is drawn down, while the patient is told to look upwards, and a drop of the solution is allowed to fall into the lower sac. The lower lid is kept pulled down to distribute the fluid, and to avoid its escape by movement. The other eye is left untested as a control for comparison.

Reaction.—A few hours after instillation, itching and smarting commence at the internal canthus, followed by lachrymation, exudation, redness and swelling of the conjunctiva most noticeable at, and in some cases limited to, the semilunar fold and caruncle (Barney and Brooke). All these symptoms are usually noticeable in three to twelve hours, but may not appear for twenty-four or more hours. They usually persist for two to four days—in severe reactions for a week. There should be little or no pain, and no constitutional disturbance.

Precautions.—(1) Since a single drop of 1 per cent. solution of tuberculin occasionally produced intense inflammation, many observers now use a ½ per cent. solution (Cornby).

(2) After instillation, the eye must not be rubbed or exposed to wind or dust.

(3) In doubtful cases in which a second test is considered necessary, the other eye should be tested and a stronger solution of tuberculin (1 per cent.) used.

(4) Avoid applying the test to an eye in any way diseased, refraction errors excluded.

Dangers.—Intense inflammation, ulceration, and subsequent nebulæ are rare, but have been recorded (Harrison Butler). Such severe sequelæ are long-lasting and require active treatment.

Statistics show that in man the reaction fails to occur in some tuberculous patients and appears in others not obviously tuberculous. It also fails in advanced cases nearing death, owing to loss of resisting powers in the patient, and in general miliary tuberculosis and tuberculous meningitis. Other diseases, such as typhoid, gonorrhœa, and rheumatism, have been recorded as causing a positive reaction. Many of the clinically non-tuberculous that react are possible tuberculous, and many observers hold that the percentage of apparent errors is well within the limits of possible accuracy. Baldwin (*Brit. Med. Journ.*, October 24,

1908) gives records of 887 patients tested, $\frac{1}{8}$ per cent. solution of dried purified "Old Tuberculin" being employed. Those that did not react positively were retested with $\frac{1}{2}$ per cent. solution in the opposite eye. Of these 887, 310 were tuberculous in some form; 208 (70 per cent.) of these reacted positively to the conjunctival test; of 265 suspected of being tuberculous 35.9 per cent. reacted positively; of 127 suffering from other diseases 14.1 per cent. reacted positively, and of 185 supposed to be healthy 18.3 per cent. gave a positive reaction. Out of all these positive reactions twenty-four only were severe, and ten of these severe cases persisted beyond five days, one developing keratitis (a scrofulous patient).

According to Wolff-Eisner (*Brit. Med. Journ.*, March 13, 1909), a healthy person will not react, and an apparently healthy person that does so usually turns out to be tuberculous. Failure to react, however, does not exclude tuberculosis, and in cases obviously tuberculous may be regarded as a bad prognostic. He does not consider the test dangerous to a healthy eye, provided it is not repeated in the same eye. Marique (*Brit. Med. Journ.*, September 12, 1908) obtained some reactions so violent and prolonged that he abandoned the method; nor does he, in view of its unreliability, think one is justified in exposing a patient to such very real risks. Calmette (*Brit. Med. Journ.*, August 28, 1909) considers a positive reaction is only obtained when the tuberculous focus contains living tubercle bacilli, and that the rapidity and intensity of the reaction depends upon the subject's vigour of defence against tuberculous infection. As in the cutaneous and subcutaneous methods, he expects a negative reaction in old cachectic tuberculous subjects. He records that out of 20,000 observations 92 per cent. of the clinically tuberculous gave a positive reaction, and only 80.4 per cent. showed serious results such as ulceration, intense conjunctivitis, &c. Among febrile patients he considers it the only test which is neither inconvenient nor dangerous.

Cattle.

Vallée was probably the first to apply the conjunctival test for diagnostic purposes in cattle. The results of experience have shown that in cattle any aqueous solution of tuberculin prepared according to Calmette's directions is unsatisfactory, better results

being obtained by using ordinary concentrated tuberculin, prepared without glycerine or carbolic acid, both of which are irritants.

Method.—The animal's head is held in a raised position, the membrana nictitans is everted by gentle pressure, and two or three drops of tuberculin instilled into the conjunctival sac. A few drops of saline or sterilized water may be dropped into the opposite eye as a control.

Reaction.—This consists in the appearance of a more or less marked conjunctivitis in from eight to twenty hours after instillation of the tuberculin. There is marked dilatation of the blood-vessels of the conjunctiva, œdema and swelling of the eyelids, and lachrymation. In more intense reactions a greyish-white exudate forms in films which are washed by the tears to the internal canthus. In very marked cases there is epiphora, photophobia, and glueing together of the eyelids by a greyish-yellow exudate. The reaction is most marked about fifteen to twenty hours after instillation, but may appear as early as the eighth hour. It may remain in evidence for some three to four days. It causes neither general nor thermal disturbance.

McCampbell and White (*Brit. Med. Journ.*, October 24, 1908) obtained the best results by using full-strength tuberculin. They, however, consider the test of limited value, as in some cases the reaction is barely a hyperæmia; but they hold that a positive reaction is sure evidence of a tuberculous lesion being present. They found that the reaction was most marked in animals not recently submitted to the subcutaneous test, which prevents the reaction for the next four weeks and diminishes its intensity for from six weeks to a year. Mohler (*American Veterinary Review*, vol. xxxiv, December, 1908) considers that the variable results obtained by this method make it unreliable and unsatisfactory. Roencke (*Journ. Comp. Path.*, vol. xxi, part iii, September, 1908) holds that as a diagnostic this method it not so reliable as the subcutaneous. Vallée asserts that if the animal be capable of reacting at all, it will do so in spite of a previous subcutaneous injection of tuberculin, and also that repetition of the test does not diminish the reaction. He records that out of eight animals of which the same eye was instilled four times in nineteen days, all gave a marked reaction on each occasion; in fact, the reaction became more intense on each successive test.

I (*Journ. Comp. Path.*, vol. xxii, part iii, September, 1909) found that out of sixty-four cows tested by this method and judged by the result of the subcutaneous test, 11.5 per cent. (three out of twenty-six) of the tuberculous animals failed to give a conjunctival reaction, and 26.9 per cent. (seven out of twenty-six) gave a barely perceptible reaction. In this series of tests, also, the reaction was most marked on the fifth day after instillation.

The Commission appointed by the Société de Pathologie comparée (Bailliart's Report) was of opinion (1) that the conjunctival test is usually without danger, if the eye is free from tuberculous disease; but that occasionally transient accidents occur; (2) that the reaction is not proportionate to the gravity of the lesion and is often absent in the last stages of tuberculosis; (3) that the reaction is not reliable, is often doubtful, and cannot replace the subcutaneous test; (4) that it occasionally causes a general reaction but that this is always slight and transient.

Conclusions.

Man.—The conjunctival test has occasionally had results disastrous to the eye; for this reason and because its uncertain efficiency does not appear to justify such risks, it has been abandoned in many of the hospitals and sanatoria in this country.

Cattle.—The test does not appear to be dangerous, but it is unreliable and cannot be used as a substitute for the more reliable subcutaneous test. It is, however, a quick and convenient method of weeding out tuberculous cattle from a large herd, and in these cases is most useful if carried out as a preliminary to the subcutaneous test (Lignières, *Journ. Comp. Path.*, vol. xxii, part iii, September, 1909).

The Combined Ophthalmo-cutaneous Test.

Cattle.

Guerin and others pointed out that tuberculous animals first tested by the instillation of tuberculin into an eye and subsequently, within a few days, by the subcutaneous injection of tuberculin, often showed an intensified revival of the conjunctival reaction in the eye first tested (secondary reaction). Moreover, in some cases where no reaction was obtained by simple instillation (primary reaction) an appreciable conjunctival reaction was obtained after the subcutaneous injection.

Jugeat (*Journ. Comp. Path.*, vol. xi, part iv, December, 1908) records 159 animals tested, first with the conjunctival reaction and at a later date with a subcutaneous injection of tuberculin. He found that in 18 per cent. the simple (primary) conjunctival reaction and the subcutaneous test disagreed, whilst in only 8 per cent. did the secondary conjunctival reaction and the subcutaneous test disagree. He therefore considered the secondary conjunctival reaction more reliable than the primary. Morel (*Journ. Comp. Path.*, vol. xxi) considers it very rare to obtain a well-marked secondary ocular reaction (*i.e.*, muco-purulent exudate) in a cow that is not tuberculous. Bailliart (*Journ. Comp. Path.*, vol. xxi) is of the same opinion and recommends the secondary reaction, as he considers it essential to have a test too severe rather than too lenient. The secondary reaction has this advantage also—it reveals the fraudulent attempt of faking an animal by subcutaneous injection prior to the official test. As a subsequent submittal to this combined test obtains the secondary conjunctival reaction in tuberculous cattle, the Société de pathologie comparée (*Brit. Med. Journ.*, October 24, 1908) considered (1) the primary reaction unreliable, but the secondary reaction less so; (2) that in the majority of cases the secondary conjunctival reaction and the subcutaneous test agreed; (3) that it is more frequent to find a positive secondary conjunctival reaction in a non-tuberculous animal than a negative reaction in a tuberculous one; (4) that a reaction is often absent in the last stages of tuberculosis.

I (*Journ. Comp. Path.*, vol. xxii, part iii, September, 1909) applied the combined ophthalmo-cutaneous test to sixty-four cattle, subjecting them to the "subcutaneous test" on the seventh day after instillation of the eye with tuberculin; and found that out of twenty-six animals that reacted positively to the "subcutaneous test," three (11.5 per cent.) failed to react to the primary conjunctical test, and seven (26.9 per cent.) gave a very slight reaction. But all twenty-six cattle gave a marked secondary conjunctival reaction. One cow, which failed to react to the "subcutaneous test," gave both a marked primary and marked secondary conjunctival reaction. In this series of investigations it was found that the secondary conjunctival reaction was most marked at the fifteenth hour after subcutaneous injection.

The Cuti Reaction.

This reaction was first described by Von Pirquet in 1907. He found that applying a drop of Koch's "Old Tuberculin" to the abraided skin of a tuberculous child resulted in a local reaction unaccompanied by any general disturbance. He found it was more feebly shown in tuberculous adults and in non-tuberculous children he failed to obtain the reaction. For carrying out the test Von Pirquet now recommends using Koch's "Old Tuberculin" in 25 per cent. solution, using as a diluent one part of 5 per cent. carbolic-acid solution, and glycerine with two parts of normal saline; weaker solutions are, however, recommended by other investigators.

Man.

Method.—Von Pirquet's original method was to clean the skin with ether, apply one or two drops of the tuberculin to it, and with a special needle make an abrasion in the skin through the tuberculin. For comparison a similar abrasion without tuberculin was made on the same arm. McNeil (*Brit. Med. Journ.*, November 6, 1909) draws attention to the superficial circulation being less accessible in the skin than the conjunctiva and recommends a careful technique, which he considers most important in order to obtain the best results. His modification is to clean the skin with ether, and then carefully chafe off the epidermis with a sharp needle until the pink cutis vera is exposed, but without "drawing blood." To this area he applies a drop of undiluted "Old Tuberculin" and rubs it in with the head of the needle. A control is made on the same arm, using 50 per cent. glycerine instead of tuberculin.

Reaction.—In twenty-four hours (early reaction) there forms at the site of inoculation a hyperæmic papule with an infiltrated base, surrounded by a bright red zone the size of a shilling. Vesicles develop on the papule, break, and scab. Resolution commences about the fourth or sixth day, and is complete in another four days, leaving a pigmented area to mark the site of the reaction. The lesion, to be typical, must have an infiltrated base and a sharp margin to the hyperæmic zone, and must also persist for at least five days. Control areas often show some congestion and swelling, but these pass off in twenty-four hours. In older children and adults the reaction is often delayed until

the forty-eighth hour (late reaction). There should be no general or thermal reaction.

McNeil, as the result of investigations in 150 patients, considers the test unreliable in advanced tuberculosis, but quite reliable in the early and chronic stages. He holds that a positive reaction is proof of tuberculous disease, whether or not the latter be clinically manifest. He found that if the general condition of the patient remain unchanged, the reaction is not prevented by repetition. Mills (*Brit. Med. Journ.*, May 14, 1910), as the result of 223 investigations, found that tuberculous patients rarely failed to give the reaction, that repetition does not prevent the reaction, and that bovine tuberculin may be used for man with results as successful as when tuberculin of human origin is employed.

McNeil, in comparing this skin reaction with that of the conjunctiva, found that the latter never gave a positive reaction in any case not positive by Von Pirquet's test, but that ten out of seventy-eight were positive to Von Pirquet's and failed to give a conjunctival reaction. He therefore considers the cuti reaction more reliable than the conjunctival. Speaking generally, statistics show that about 90 per cent. of tuberculous children give a positive reaction to this cuti test.

Cattle.

Vallée was the first to apply the test to cattle. As the site of inoculation he selected the back of the neck or the withers.

Method.—He first shaved the skin and washed it with sterilized water; then lightly scarified through the epidermis and dermis until blood began to ooze. Using a sterilized brush he painted this area with Koch's "Old Tuberculin" (diluted with an equal part of boiled water).

Reaction.—About twenty hours after inoculation an œdematous swelling appeared along the lines of scarification, and increased to its maximum during the next twenty-eight hours. The swelling persisted for four to five days, when a crop of papules appeared which lasted some two or three days before desquamating, and leaving a surface from which serum oozed. Resolution usually occurred about the eighth to the fifteenth day. In cases scarified too deeply there was much induration and considerable hyperæsthesia of the part. In no case was there any general

or thermal disturbance. In healthy cattle the resulting redness and swelling was very transient. Comparing this reaction with the subcutaneous test, Vallée found (1) that cattle giving a marked subcutaneous reaction gave also a good cuti reaction, but the intensity of the latter was not proportionate to the extent of the tuberculosis; (2) that a subcutaneous injection of tuberculin two to three days prior to the cuti test considerably diminished the action of the latter; (3) that tuberculous cattle injected subcutaneously with tuberculin on the fifth day of the cuti reaction gave a pronounced typical temperature reaction, in addition to the cuti reaction already in evidence.

Vallée has shown that, as to the subcutaneous reaction, cattle acquire a tolerance to the cuti reaction, and he recommends that four or more weeks be allowed to elapse before repeating the test. Reinecke (*Journ. Comp. Path.*, September, 1908), in carrying out his investigations, shaved and cleansed the withers, and used an instrument consisting of eight small blades 5 mm. apart, which were sufficiently long to "draw blood." He used concentrated "Old Tuberculin" diluted with an equal part of boiled water, and applied with a sterilized brush. Of the twenty-five animals tested only one reacted, and this one showed no tuberculous focus on *post mortem*. The subcutaneous test showed six of these to be tuberculous, and *post-mortem* examination revealed eight more.

It has been established that animals which react to the subcutaneous test may fail to react to the cuti test; so that apparently the reliability of the latter does not compare favourably with the ordinary subcutaneous test.

The Dermo Reaction.

Man.

Moro found that in a tuberculous man a skin reaction could be obtained with tuberculin, applied by gentle friction, without previous scarification. He used an ointment consisting of equal parts of "Old Tuberculin" and lanoline. This he rubbed into the skin of the chest or abdomen, and in a tuberculous subject obtained either an eruption of red papules or a diffuse dermatitis of the part. This reaction, though interesting, is not reliable, and cannot be considered trustworthy.

Cattle.

Lignière carried out similar investigations in cattle. He obtained a local reaction in tuberculous cattle by rubbing a shaved area of skin with concentrated tuberculin. He selected the loose skin of the side of the neck, shaved a few square inches of it, and rubbed in several drops of "Old Tuberculin." In tuberculous cattle, in about twenty-four hours, the skin became swollen and red, and developed a crop of vesicles; but in healthy cattle no such reaction occurred. The reaction varied greatly in severity, was unaccompanied by any thermal disturbance, and persisted for several days. A subcutaneous injection of tuberculin given at the same time did not affect the reaction; but an injection two or three days previously prohibited or, at the least, delayed it.

Vallée (*Proc. Soc. Cent. de Méd. Vét.*, October 16, 1908) carried out this test on eighteen cattle that had reacted to the subcutaneous test, and that at a subsequent *post-mortem* examination proved to be tuberculous; ten only, however, gave a distinct and characteristic reaction, whilst five failed to react at all.

THE INTRADERMIC REACTION.

Like the dermo reaction, this is a modification of Von Pirquet's scarification method, the tuberculin being injected into the thickness of the skin.

Man.

Mantoux found that in man an injection of tuberculin (1/100 mg. for children) into the thickness of the skin resulted in a distinct local reaction in tuberculous subjects, and without either thermal or constitutional disturbance.

Cattle.

Moussu applied this method to cattle, selecting the fold of skin at the root of the tail, so as to conveniently compare the other fold. He injected two drops of 10 per cent. "Old Tuberculin" into the thickness of the skin. In non-tuberculous cattle this resulted in no local reaction, but in tuberculous cattle an œdematous swelling, the size of a walnut, developed, and persisted three or four days. He found that tuberculous cattle never failed to give a reaction, and he obtained equally successful

results with swine, goats, and sheep. In swine, however, the swelling showed a hæmorrhagic area, which remained four or five days after subsidence of the swelling. A subcutaneous injection of tuberculin a day or so prior to carrying out this test prevents the reaction, but the intradermic test does not interfere with a subsequent subcutaneous test.

Vallée (*Proc. Soc. Cent. de Méd. Vét.*, October 15, 1908) carried out this test on seven tuberculous cattle, and obtained five positive reactions and two failures.

The Comparison of the Various Methods in Cattle.

In comparing the practical value of the various tuberculin tests, none of the local methods give sufficiently reliable results to warrant their substitution for the subcutaneous test, which must still be considered the most satisfactory. There are, however, instances where, from one cause or another, the subcutaneous test cannot be adopted, and one needs then to adopt the most reliable local method or methods. If the general test cannot be adopted because of thermal oscillation or hyperpyrexia, the most reliable results will be obtained by the secondary conjunctival reaction. Of the other local tests the most reliable is probably the intradermic method; but there is no reason why several of the local reactions should not be carried out simultaneously.

COMPARATIVE ANATOMY OF SUPERNUMERARY DIGITS IN CERTAIN UNGULATES AS EVIDENCE OF THE INTER-RELATIONSHIP EXISTING BETWEEN THE VARIOUS SPECIES.

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Second Article.*

Case III.

The third case was one of the most interesting of the series of cases. It consisted of the metacarpal and digital portions of the left limb of a pony which possessed an external accessory digit presenting a very high degree of organization.

* The first article of this series was published in The Veterinary Journal for March, 1911.

A superficial examination revealed an abnormal breadth at the metacarpo-phalangeal joint, and below the joint there were two digits distinctly separated from each other. The outer digit was the smaller, the toe of the hoof of which extended to a point about midway down the anterior surface of the hoof of the other digit upon which it lay. Its palmar aspect fell short of the level of the palmar aspect of the other digit by about half an inch, so that it was not weight-bearing.

A well-marked vertical fissure could be felt at the front of the fetlock slightly to the outer side of the middle line.

At first glance this specimen appeared to belong to the Schistodactyles of Lesbre, with one of the digits slightly deformed, but a detail examination showed it to be a member of the Polydactyles.

The Tendons.—The tendon of the anterior extensor of the digit (extensor pedis) ran down the antero-external border of the large metacarpal bone. At the junction of the middle and lower thirds of the bone it split into two divisions, the larger of which passed over the front of the fetlock joint of the principal digit and broadened out on the front of the first phalanx. Midway down the shaft of this bone, a branch of the superior sesamoidean ligament which made its appearance round the inner aspect of this digit, blended with the inner edge of the tendon, and the latter then passed over the first interphalangeal (or pastern) joint and continued its course in the middle line to its insertion into the pyramidal process of the terminal phalanx. At the pastern joint it took the place of an anterior common ligament and gave support by its deep face to the synovial membrane of the joint.

The other division of the tendon separated at an acute angle and then passed obliquely downwards and outwards on the anterior face of the other digit. Running over the front of the fetlock joint of this digit it detached a small slip of insertion into the upper extremity of its first phalanx, to the outer side of which the slip was attached. The tendon then passed as a narrow cord down the front of the first phalanx and over the first interphalangeal joint, where it became slightly expanded. Its insertion was into the proximal extremity of the third phalanx in the elevation which corresponded to the pyramidal process. The tendon of the superficial flexor of the digit (flexor perforatus) presented no peculiarity until the lower third of the metacarpal region was

reached, when it divided. The inner and larger division passed straight down the limb over the back of the fetlock, formed the usual fibrous tube for the passage of the tendon of the flexor perforans, and then split into two portions, which were attached one on either side of the second phalanx at the posterior aspect of its upper extremity. The other division running obliquely downwards and outwards gained the posterior surface of the expanded portion of the sesamoid bone of the accessory digit over which it played as a tube which enclosed the corresponding portion of the tendon of the deep flexor. It did not divide, but was inserted as a broad band into the back of the upper extremity of the first phalanx.

The tendon of the deep flexor (flexor perforans) also divided between the middle and inferior thirds of the metacarpal region into two portions, one of which ran down the back of the principal digit to be inserted into the semilunar crest of its terminal phalanx after emerging from the tube formed for it by the tendon of the superficial flexor. The other division took a similar course in relation to the portion of the superficial flexor tendon on the back of the smaller digit, and was inserted into the inferior aspect of its terminal phalanx.

The Suspensory (or Superior Sesamoidean) Ligament.—This structure was particularly well developed. It had the usual origin from the back of the lower row of carpal bones and the upper extremity of the large metacarpal. Running down the channel formed between the large and two small metacarpal bones, it divided into two portions at the middle third of the metacarpus. The larger division, as might be expected, ran down the back of the larger digit, but after a course of about an inch this portion divided and the outer division took a vertical course downwards. It obtained insertion into the apex of the outer sesamoid bone of this digit. The inner division took an oblique course downwards and inwards, and after giving a slip of insertion to the postero-external surface of the corresponding seseamoid bone, it passed obliquely round the side of the metacarpo-phalangeal joint and blended with the tendon of the extensor pedis on the front of the middle third of the first phalanx.

The smaller of the two divisions of the main ligament passed obliquely downwards and outwards along the back of the outer small metacarpal bone and in intimate relationship to it. About

an inch above the fetlock joint of this digit, the ligament divided into two portions, and these were inserted into the superior extremities of the two divisions of the sesamoid bone, the outer division being in consequence the longer but was more slender.

On the accessory digit there was present a small but well-developed lateral ligament of the fetlock. This consisted of a slender band which passed from the outer side of the distal extremity of the external small metacarpal bone to the outer surface of the nodular part of the sesamoid bone, and another band arising in the same place and running downwards and backwards to be attached to the postero-superior angle of the first phalanx.

There was also present on the accessory digit a well-defined V-shaped division of the inferior sesamoidean ligament which ran from the base of the sesamoid bone to the back of the first phalanx, but there was no trace of the superficial division nor of the deep-crossed bundles of this ligament.

The Arteries.—The Large Metacarpal Artery (Fig. VII. 2).—A vessel of considerable calibre ran down the inner border of the tendon of the flexor perforans. Before arriving at the fetlock joint of the main digit the vessel dipped between the perforans tendon and the inner main divisions of the suspensory ligament. In the angle of bifurcation of this ligament, the vessel split into two digital arteries.

The Internal Digital Artery (Fig. VII. 16).—This made its appearance superficially on the inner aspect of the limb between the perforans tendon and the inner branch of the larger of the main divisions of the suspensory ligament. It then took the usual course to the inner aspect of the lateral cartilage, where it divided into plantar and preplantar vessels.

The External Digital Artery (Fig. VII. 8).—This passed downwards and outwards between the perforans tendon of the main digit and the vertical band of the inner division of the suspensory ligament. After a length of about an inch this vessel divided, the inner portion being continued as the outer digital artery of the main digit (Fig. VII. 15). Near the first interphalangeal joint it gave off a branch which passed on to the inner surface of the accessory digit, to the terminal portion of which it was distributed.

The other division of the external digital artery (Fig. VII. 9) passed transversely outwards almost at right angles to the parent

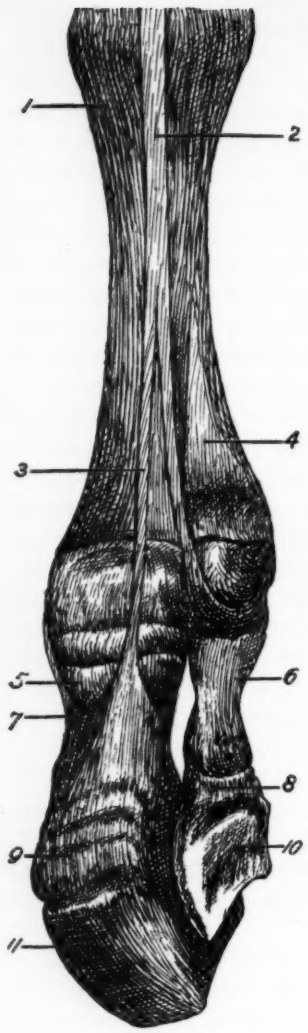


FIG. VI.

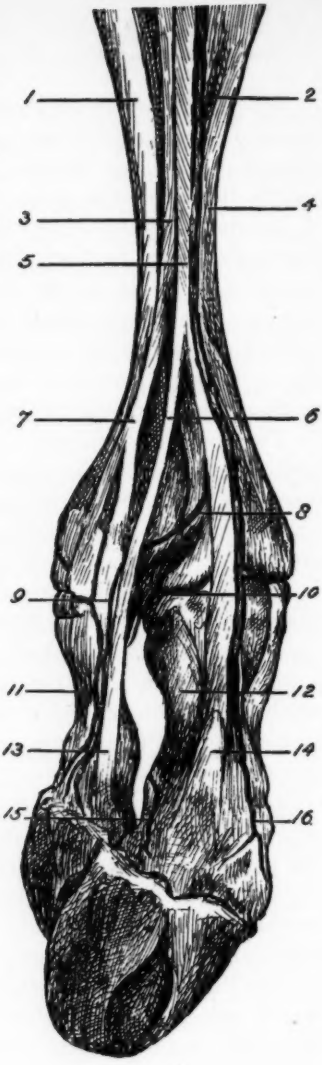


FIG. VII.

CASE III.

FIG. VI.—1, large metacarpal bone; 2, tendon of anterior extensor (extensor pedis); 3, division of anterior extensor to principal digit; 4, outer small metacarpal bone; 5 and 9, first and second phalanges of principal digit; 6 and 8, ditto of accessory digit; 7, branch of suspensory ligament; 10, hoof of accessory digit; 11, hoof of principal digit.

FIG. VII.—1, outer small metacarpal bone; 2, large metacarpal artery; 3, suspensory ligament; 4, inner small metacarpal bone; 5, tendon of flexor perforatus; 6, division of same to the accessory digit; 7, branch of the suspensory ligament to the accessory digit; 8, external digital artery; 9, outer digital artery of accessory digit; 10 and 15, outer digital artery of main digit; 11, first phalanx of accessory digit; 12, ditto of main digit; 13, division of tendon of flexor perforatus to accessory digit; 14, ditto to main digit; 16, internal digital artery of the main digit.

vessel, and running beneath the flexor tendons of the accessory digit gained the outer border of the corresponding portion of the tendon of the flexor perforans. The vessel followed the edge of this tendon to the inferior third of the first phalanx. Here it split into two portions, one of which was distributed to the front and outer lateral aspect of the terminal portion of the digit, whilst the other division, which was the larger, followed the posterior face of the perforans tendon, after the latter had emerged from the ring formed by the flexor perforans, and was finally distributed to the outer half of the extremity.

The Bones.—The inner small metacarpal bone (Fig. VII. 4) presented the usual features, excepting that it was very ill-developed. The large metacarpal bone was narrower in its inferior half, and the lower third of its outer border was flat and roughened for the attachment of the outer small metacarpal.

The Outer Small Metacarpal (Fig VII. 1).—This presented several peculiarities, since it carried the accessory digit. Its length was only an inch shorter than that of the large metacarpal. The whole bone presented a somewhat spiral appearance, the shaft being twisted in its length. Its superior extremity was much larger than that of the inner small metacarpal. Its shaft presented three surfaces. The inner, in its superior half, was flattened, and bounded the channel for the accommodation of the great suspensory ligament. The anterior surface was more or less flattened and firmly attached to the large metacarpal bone. In its lower third it faced directly inwards. The outer surface was concave in its length and convex in the transverse direction. Owing to the twisting of the bone, the inferior third of this surface looked forwards, and this portion was blended with the inner surface, the border separating the two surfaces being here smooth and rounded off. The lower extremity of the bone was much more massive than the upper. Inferiorly it was articulated to the superior surface of the first phalanx, and it presented four other surfaces, namely, an inner which was articulated to the outer surface of the distal epiphysis of the large metacarpal bone, a posterior which was articulated to the front of the sesamoid bone, and anterior and external surfaces which were blended and roughened for ligamentous attachment. The distal epiphysis of this small metacarpal bone ossified from a centre distinct from the shaft, the line of division between diaphysis and epiphysis

being still clearly indicated by a well-marked groove which encircled the bone.

The remaining bones of the large digit presented normal characters, with the exception of the terminal phalanx, the appear-

CASE III.

FIG. VIII.—Posterior aspect.

ance of which was much distorted. It was articulated to the second phalanx in such manner as to form a lateral angle externally, so that in addition to the sole part of the internal portion of the wall at the back also came into a position with the ground.

One *sesamoid bone* was present on the supernumerary digit. This was of most peculiar shape and consisted of outer and inner portions, the latter being very much the larger. The outer portion was more compressed from before to behind and elongated from above downwards. The superior border extended to a much higher level than did that of the outer portion. As already stated, divisions of the suspensory ligament were attached to their upper borders. The sesamoid bone was further held in position by a band which passed from its inferior border to the back of the upper extremity of the first phalanx. The bone was encircled by a groove and the two portions developed from separate nuclei.

The *first phalanx* was slightly more compressed from side to side. The inner surface was concave in order that the concavity might accommodate the broad upper extremity of the first phalanx of the main digit, otherwise the bone presented the ordinary characters, excepting that the V-shaped roughened area on the posterior surface was very faintly marked.

This case is evidently a member of the simple Polydactyles. It is extremely interesting, however, inasmuch as it seems to represent a possible transition stage between a typical member of this class and one of the Schistodactyles. Evidence in support of this is found in the following points:—

(1) The diminished size of the internal small metacarpal bone —it appeared to be gradually blending with the large metacarpal.

(2) The size of the external small metacarpal.

(3) The form and position of its inferior extremity. A reference to Fig. VI. will show that this end has forced itself alongside that of the main digit.

(4) The blending of the upper end of this small metacarpal with the large.

(5) The tendency to a symmetrical conformation in the small digit, including the hoof.

Case IV.*

This is the pes of an ox, showing a most perfectly formed supernumerary digit.

In this case, however, as a glance at Fig. IX. will show, the

*From the *Journal of Comparative Pathology*, vol. xv, pp. 143-146. (By kind permission of the Editor, J. S. J.)

abnormal digit, in addition to being to a certain extent weight-bearing, which is in itself somewhat remarkable, is most symmetrical in outline, and is developed to a degree which is almost on an equality with the normal ones.

The principal points of interest brought to light by the dissection of the pes were the following:—

Muscles.—Just above the fetlock the extensor proper of the middle digit gives off a branch which is continued downwards over the anterior aspect of the abnormal digit. When about the middle of the os suffraginis, this branch divides (Fig. IX. B), but a little lower down these sub-divisions reunite, and there thus seems to have been an arrest in the progress of development, and a tendency, as it were, to revert to the prevailing type. Lower down, however, the reunited tendon again divides, and we have an arrangement comparable to that found in the normal case, namely:—

(1) An external division, which may be said to correspond with the extensor proper of a normal digit, and which in turn divides into:—

(*a*) A thick cord-like tendon, which is continued downwards and becomes inserted into the anterior face of the second phalanx.

(*b*) An expanded sheet-like portion which becomes inserted into the side of the pedal bone. This flattened portion receives the branch of the suspensory ligament, which in Fig. X. A is seen to pass round the external lateral aspect of the accessory digit.

(2) An internal division (Fig. IX. B) thick in front, but flattened posteriorly and becoming inserted into the pyramidal process of the pedal bone. This division may be said to represent one of the branches of the common extensor of the two normal digits. The above-mentioned branch of the suspensory ligament has the usual arrangement, being given off from the more deeply seated of the two main branches into which the ligament divides. In Fig. X. it is also distinctly seen that the more superficial of the two main divisions of the suspensory gives off a branch which descends almost vertically to the back of the fetlock, where it assists the perforatus tendon in forming the ring through which the tendon of the perforans passes. In the same illustration the perforans tendon is also seen entering the ring, and lower down

it is again visible after passing through the little fibrous band below the fetlock.

A posterior view of the specimen is given in Fig. X., and in it the three divisions of both perforatus and perforans are observed to be almost equal in size (the perforatus tendon has been slightly pushed aside above the fetlock to bring the perforans into view). Another point which is here worthy of notice is the extremely well-developed band through which the perforans passes below the fetlock.

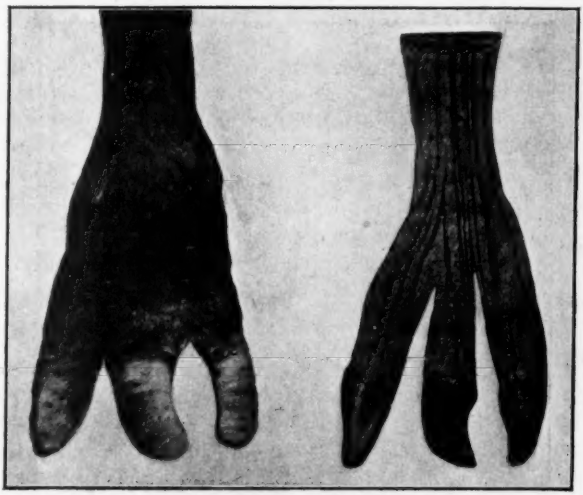


FIG. IX. A. FIG. IX. B.

CASE IV.

FIG. IX. A.—Anterior aspect with skin on. FIG. IX. B.—Anterior aspect with skin removed, showing tendons. (From *Journal of Comparative Pathology*, vol. xv.)

The Bones.—The posterior surface of the large metatarsal is flattened, and gradually widens out at its lower extremity, which is about double the width of the upper. Near the latter extremity this surface shows two foramina which are the inferior openings of canals leading from the upper articular surface. Two faint grooves traverse the length of the bone and terminate inferiorly, one in a foramen which is the posterior opening of a canal conducting to the anterior surface, the other in a cleft about an inch in length, which also passes through the bone. The inferior

extremity presents three pulley-like articular surfaces, the abnormal one differing from the other two in possessing an antero-posterior ridge which divides it into two areas almost equal in size and upon the same level.

There are five sesamoids, the accessory digit having only one. This one, however, is peculiar inasmuch as it seems to suggest that the digit at one time possessed two, for in appearance it very much resembles two sesamoids which have become fused together. Anteriorly it has four facets, the two central ones

FIG. X. A. FIG. X. B.

CASE IV.

FIG. X. A.—Lateral aspect. FIG. X. B.—Posterior aspect. (From *Journal of Comparative Pathology*, vol xv.)

being for articulation with the ridge and the other two for articulation with the remainder of the pulley-like inferior extremity of the large metatarsal. Inferiorly it articulates with the os suffraginis by two facets which are separated by a non-articular depressed area, and posteriorly it is divided by a vertical groove into two markedly convex areas. It is thus entirely encircled by

a constriction which may possibly indicate the line of fusion of two originally distinct bones. The supernumerary first phalanx in shape more nearly approaches that of the horse, whilst the upper extremity of the second phalanx has a much more extensive articular area than the corresponding normal bone, and is devoid of the small upward projecting peak-like process found in the latter. The two buttress-like processes which posteriorly bound the upper articular surface of the os coronæ differ from the normal in being almost equal in height, and the recurved non-articular area which encroaches on the posterior surface is much smaller.

The articular area at the inferior extremity is much less extensive, but the antero-posterior groove is very well marked, being much deeper than those found in the corresponding bones of the other two digits.

Three navicular and pedal bones are present. The additional navicular is smaller than normal, but is very well formed and possesses facets for articulation with the os coronæ and pedal bone. The abnormal pedal bone is quite equal to the other two in size, but is slightly different in shape, being more compressed from side to side. The preplantar grooves on the external and internal laminal surfaces are much more distinctly marked. The solar surface is quite flat and in form resembles an elongated isosceles triangle with the apex at the toe. The general appearance of this bone much more closely resembled the corresponding bone of the horse, and a point of great interest is the still stronger resemblance which it bears to the terminal phalanx of the central digit in Case V.

Clinical Articles.

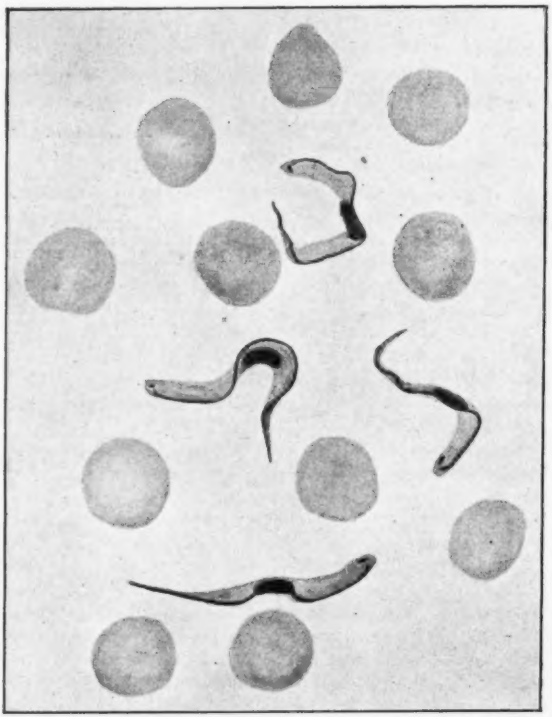
HORSE TRYPANOSOMIASIS OF ZANZIBAR.

By J. A. N. DA CUNHA, G.B.V.C.

Veterinary Officer to the Government of H. H. the Sultan of Zanzibar.

THERE can be no doubt that cases of trypanosomiasis are not of a very common occurrence in Zanzibar.

It was in February, 1908, that Dr. A. Edington, at that time bacteriologist to the Zanzibar Government, recorded an interesting



× 2,800. A composite field.
The drawings show the type of trypanosomes.

horse trypanosome which he described as "of a size somewhat like that of a trypanosome dimorphon but rather more delicate, and the

blunt end frequently tapered to an abrupt point which was somewhat characteristic."

Repeated efforts made by the writer throughout the island on various subsequent occasions have so far resulted in the discovery of a second case in a grey Australian gelding, aged 13, with the following symptoms : Intermittent fever (with alternate paroxysms of a short and irregular duration), membranes pallid, swelling of hind limbs, sheath and floor of the abdomen. Greedy appetite, enormous thirst, profuse urine, great loss of strength and condition.

Upon the evidence of this type of fever, very characteristic of the disease, blood smears were examined microscopically and the presence of trypanosomes demonstrated.

Facts regarding the existence of blood-sucking flies in different parts of this island go to prove that with the exception of five varieties known as the tabanus, stomoxys, hippobosca, chrysops and hæmatopata, no other species of any special interest have yet been seen.

[We are indebted to Mr. A. L. Sheather, M.R.C.V.S., B.Sc., for the drawings of the trypanosomes from slides forwarded to us by Mr. da Cunha. The trypanosomes were taken from several fields, and were drawn by the aid of the camera lucida × 2,800.—Eds. *V. J.*]

CHOKING TREATED SUCCESSFULLY WITH CHLOROFORM.

By W. LOTHIAN, M.R.C.V.S.

Duns, Berwickshire.

On May 1, I was asked to see a year-old stirk in poor condition, which had been ill two days, and which was suspected of being choked with a piece of turnip. On examination the obstruction could be felt in the gullet half-way down the neck. The probang was used, but with no effect; it (the obstruction) was firmly lodged and could not be moved on. Two or three more attempts were made, but failed. I now administered chloroform, which I had taken with me, after being informed it had been ill from the Saturday to the Monday. As soon as the animal was fairly well under I passed the probang, this time with success, the spasm seemed to be well relaxed and there was

little difficulty in getting the piece of turnip forced down the œsophagus.

This is the second case I have used chloroform for choking. The first time being in a quey. The first day I saw it I failed to get the obstruction, which was a piece of turnip, removed by means of the probang. I went back next day, tried probang again with no better result. It then occurred to me to try chloroform and see if it had any effect in removing the spasm of the gullet. After the animal was completely under its influence I passed the probang and the obstruction was removed with perfect ease, the weight of the probang carrying it away with little or no effort.

It appears from these two cases that chloroform would be well worth a trial in cases where other means had failed before performing œsophagotomy or where the obstruction was in the thoracic portion of the œsophagus.

TWO CASES OF EQUINE TUBERCULOSIS (MOTHER AND DAUGHTER).

By J. A. GILRUTH, D.V.Sc., M.R.C.V.S., F.R.S.E.

Professor of Veterinary Pathology, Melbourne University Veterinary School.

Two interesting cases of equine tuberculosis, probably the first observed in Australia, occurred in the practice of Mr. W. A. Kendall, G.M.V.C., and the relationship of the affected animals as well as the possible source of the infection being interesting, the cases are worthy of record.

The following is the history as kindly supplied to me by Mr. Kendall:—

"While at a farm at Elwood, attending to another case, my opinion was asked regarding a brown pony mare, aged about nine years, which, the owner informed me, had been gradually wasting away for some months.

While approaching the mare in the paddock, I noticed she was standing in a peculiar manner; the body being huddled up, and the off-foreleg advanced and slightly bent at the knee and fetlock.

On remarking about this to the owner, I was informed that the mare was not lame and could trot fairly freely; but while resting or grazing this limb was always placed in this peculiar manner.

On examination the general symptoms were those of some chronic generalized disease, and after examining the udder and lymphatic glands, I was led to suspect generalized tuberculosis.

While making further inquiries regarding the history of this animal, the owner informed me that he had hand-reared her as a foal on cow's milk, and that the cow, from which the milk was obtained, was not "a good doer."

I suggested applying the tuberculin test, but the owner would not agree to this course, and stated that he would try good nourishing food and tonic treatment for a month and if there was no improvement in that time he would destroy the animal.

About six weeks later I received a telephone message informing me that the mare had been destroyed and was being taken to the boiling-down works.

I telephoned to the works and asked the proprietor to save any specimens and send them along.

Next day I received a spleen which was very much enlarged and covered with numerous irregular pale coloured areas, which, on section, were seen to contain a varying quantity of caseous matter.

I forwarded the whole specimen to Professor Gilruth, who kindly reported that the case was one of tuberculosis.

I reported the result of the examinations, &c., to the owner, who then asked me to examine another mare, which, I was informed, was a daughter of the other case I had examined.

The owner had noticed she was falling away in condition and was showing the peculiar way of holding the off-foreleg.

This mare, if anything, showed more characteristic symptoms; great emaciation and weakness; diarrhœa and chronic pulmonary lesions.

On careful examination of the thoracic cavity by percussion and auscultation, a large quantity of fluid could be detected, the dull area extending well above the inferior third of the cavity; the pulmonary sounds were dull, and, towards the posterior extremities of the lungs, were entirely absent.

The udder was abnormal in size and very firm, with the

characteristic nodular condition. At the anterior border a large ulcer or cavity containing caseous matter was detected.

The retro-pharyngeal lymphatic glands were enlarged; but there was no characteristic cough.

I had no hesitation, after my previous experience, in diagnosing generalized tuberculosis in this case and recommended immediate destruction.

The animal was destroyed and the carcase removed to the most convenient place for a *post-mortem* examination, which, by Professor Gilruth's special wish, was carried out under his personal supervision.

In recording the above cases I wish to draw attention to the peculiar manner of holding the off foreleg; unfortunately I cannot describe this peculiar symptom in a more elaborate manner: it seems to have been a characteristic symptom in these cases, because the owner practically diagnosed the second case, after hearing the result of the microscopical examination of the spleen from the first case, from this symptom alone.

With the exception of the absence of a cough, the other symptoms shown were similar to those in a case of generalized tuberculosis in the ox."

The spleen of the first case was seen to be enormously enlarged, the centre being composed of a large irregularly spherical fairly dense mass about 5 in. in diameter, which on section showed numerous small degenerated caseous areas above the size of a pin-head scattered throughout. In the more normal substance of the spleen were numbers of smaller tumours varying from the size of a small pea to an orange, but these showed little and often no caseation. The lymphatic glands bordering the organ were enlarged and showed many small miliary tubercular-looking areas.

Smears of the caseous material examined microscopically demonstrated cocci and bacilli of various kinds, and when stained by Zeihl's method numbers of acid-fast bacilli morphologically characteristic of tubercle bacilli were seen lying both within and without cells.

Sections of the new splenic growths showed the typical histology of tubercular tissue with large numbers of giant cells and many tubercle bacilli, vacuolated and more like human tubercle bacilli than bovine.

On the second case we were able to make a hurried, though

fairly complete, *post-mortem* examination, the following being the notes:—

Filly pony, five years old. Body emaciated.

Post-mortem examination was made about four hours after death. Unfortunately for a variety of reasons time and situation did not permit of as complete and exhaustive an examination as could have been desired, yet an extremely interesting picture was presented.

The Udder.—Much larger than the normal non-lactating organ and firm in consistency. On section it was fibrous and infiltrated with caseous areas varying from the size of a pin-head to a small pea. The lymph glands on each side were enlarged, firm and somewhat nodular in appearance, and on section semi-caseous areas of varying size were found throughout the substance.

The Abdominal Cavity contained a very large quantity (estimated at 3—4 gallons) of straw-coloured effusion. The peritoneum was covered with small tubercles varying in size from a pin's-head upwards, the portion covering the diaphragm being thickly studded. The omenta and the mesentery showed a characteristic tubercular deposit, the tubercles being generally the size of a split pea. The serous coverings of the stomach and intestines, and all abdominal organs, also showed tubercular granulations, irregular in shape and distribution, some being distinctly pedunculated, and adhesions between folds of the intestines and between intestines and viscera were common.

Spleen.—Enormously enlarged, weighing 12 lb. Several large circumscribed abscesses containing caseo-purulent material, from a walnut to orange size were found situated, especially near the borders. Throughout the organ were numerous smaller tubercles, varying in size from a pin-head to a small pea, while a few others were the size of a marble.

Liver.—Greatly enlarged; weight, 35 lb. Dense and fibrous in consistence. On section the whole substance was seen to present a mottled appearance, owing to the enormous numbers of miliary tubercles scattered throughout the whole organ, apparently affecting each hepatic lobule.

Kidneys.—Beyond the serous covering being markedly tubercular appeared normal. The capsule stripped easily, the substance was pale on section, with here and there a small hæmorrhage.

Uterus normal so far as the mucous surface and wall were concerned.

Stomach and Intestines normal.

The Posterior Aorta was surrounded anteriorly by tubercular liver, and backwards as far as the bifurcation by masses of tubercular tissue which had their origin in the enormously enlarged sublumbar lymph glands. The whole of the vessel wall was more or less infiltrated with tubercular tissue, and its internal surface showed numerous nodules projecting into the lumen, though none were eroded.

All the lymphatic glands of the abdomen were greatly enlarged and studded with tubercular caseous foci varying in size.

The Thorax contained about 1½ gallons of straw-coloured effusion. The pleura was thickly covered with small tubercular nodules.

The Lungs were intensely infiltrated with very small miliary tubercles, the whole tissue on section presenting the appearance of a pinkish surface covered with greyish granules as of ground rice. The postero-superior portions of each lung were most severely affected, the new tissue having so completely obliterated the alveoli that pieces sank on being placed in water. Scattered irregularly throughout the lungs in addition to the minute tubercles were larger caseous masses about the size of a pea.

The Pericardium contained about 10 oz. of straw-coloured fluid. The epicardium at the region of the auriculo-ventricular groove was distinctly roughened and hyperæmic, as if in the earlier stage of tubercular invasion. The heart otherwise, beyond being pale, was not abnormal.

The whole of the lymph glands of the thorax were extensively invaded and greatly enlarged. The bronchial and anterior thoracic group formed a large dense mass, while the mediastinal glands were enormously enlarged. The superior and inferior thoracic chains were distinctly visible, each gland being the size of an almond. The submaxillary and pharyngeal glands were affected with tubercular areas.

Practically every lymphatic gland of the body was affected with tuberculosis. In no case was the whole of the gland caseous as in cattle, the caseous material being circumscribed by new fibrous tissue of but little density. In no instance was calcareous material encountered, and the pus was greyish and never firm in consistency.

Microscopical Examinations of pus from the udder, spleen, lungs, and all caseous areas showed masses of tubercle bacilli. The bacilli are long, thin and generally vacuolated. In the caseous material, particularly from the spleen, they seem to compose the whole of the substance, no cell elements and but little granular material being evident, smears having the appearance of pure cultures.

The evidence, which points strongly to infection of the filly with bovine tubercle bacilli directly from milk, and this is supported by the ready growth of the bacilli on ox-bile potato, and by the other cultural characters.

FRACTURED VERTEBRÆ—A CORRECTION.

In Captain Nicholas's case, reported in the VETERINARY JOURNAL of last month on pages 283-4, the time of death should read 5 a.m., not 5 p.m.

Canine Clinical Note.

THE TREATMENT OF FOLLICULAR MANGE WITH ETHYL-CHLORIDE.

By J. B. BUXTON, M.R.C.V.S., D.V.H.
Barent.

READING a short time ago an account of the treatment of follicular mange in the dog with ozone and electricity I wondered if many members of the profession had tried ethyl-chloride as a curative agent, and if so with what results. In some cases I have found it to answer very well, and the following notes may be of interest to those who have not yet tried it.

Case I.—An Irish Terrier dog, 10 months old, was brought to me in August, 1910, showing typical lesions of follicular mange, the parts affected being the lips, nose, top of head, and along the back. The skin was thickened and there was a crust over the affected areas, those along the back being more or less circumscribed and covered by the overhanging neighbouring hair. The material from the pustules on microscopical examination showed the demodex in large quantities in each lesion. The parts were thoroughly cleansed and dried and the surrounding hair removed. The ethyl-chloride

was then sprayed on slowly until the skin was insensitive to the prick of a needle, and the application continued for about a minute, care being taken not to freeze the skin too hard in case of subsequent necrosis. In the case of each of the areas, with the exception of one lip, a second application was not necessary, and healing of the parts was rapid, the treatment consisting of the application of antiseptic powder as for an open wound. The hair was slow in growing, and then very thin, while one small area on the back remained nude. A laxative diet was given and tonics were used. The animal seen three months later appeared to be quite recovered.

Case II.—An Irish terrier dog, litter brother to the above, was treated at the same time and in the same manner, but recovery was slower owing to the fact that the whole chest was affected besides the head, nose, paws, and inside of fore limbs. A small area inside the left fore limb became necrotic owing to the skin having been frozen too severely, but the ultimate recovery was excellent.

Case III.—A bull-terrier bitch, 6 months old, was brought to me in April of this year in a very advanced state of follicular mange. The whole of the chest and throat, besides the head, lips, eyelids, and inner surface of all four limbs and paws were affected. The skin was thickened and riddled with holes as though it had received a charge of small shot, while there was the usual yellow crust on the removal of which pus exuded. The demodex was demonstrated on microscopical examination. The animal was in an extremely emaciated condition and very weak. After changing and drying the parts the ethyl-chloride was applied, but, unfortunately, the animal died the fourth day after admittance.

Case IV.—An Airedale bitch, 12 months old, was brought to me May 3 suffering from follicular mange, the demodex being found in the pus. The lesions were not extensive, and were confined to the chest and paws. The treatment was the same as for the above, but the paws required a third application ; the result, however, was satisfactory and recovery seems complete.

It would be interesting to know what success other practitioners have had with this treatment, as it seemed to me very effective, the only drawback to it apparently being the care necessary in its application and the risk of subsequent necrosis.

Abstracts.

THE BACTERIOLOGY OF COMMERCIALLY PASTEURIZED AND RAW MARKET MILK.*

By S. H. AYERS and W. T. JOHNSON.

Pasteurization is a term which needs no explanation, nor is it necessary to review its history. The general public has been liberally informed during the past two years as to what the pasteurization of milk means. It is true that newspaper articles often are misleading, and the minds of the people have been led to favour or oppose pasteurization largely through popular articles in the press or advertisements of dairies, which either point out the value of or the danger from pasteurized milk.

But the question as to pasteurization is not unsettled in the public mind alone; the subject is one which has caused a division of opinion also in the medical profession and in the scientific world. There are those who oppose pasteurization and those who are in favour of it. Some oppose it under any condition; others admit that it should be resorted to under exceptional conditions.

It may be asked with fairness why such a division of opinion exists among even those who have made milk problems a life study. Only one answer can be given, namely, that the subject of pasteurization has as yet been touched only upon the surface, notwithstanding the numerous valuable pieces of research work which have been published concerning it.

Modern Theories of Pasteurization.

Since the pasteurization of milk has become extensively practised and is advocated by health officers and other authorities on milk, obviously there must be some advantages connected with the process. Some of the points of value in pasteurization which serve as a foundation for the opinions of those who advocate the process may be considered first.

Advantages Claimed for the Process.—When the *rôle* that raw milk plays as a vehicle of disease and the ease with which it may become infected are considered, obviously the principal advantage of pasteurization is in the destruction of pathogenic organisms. It has been shown by many investigators that *Bacillus tuberculosis*, *B. typhi*, *B. diphtheriæ*, and the dysentery bacillus are destroyed when milk is pasteurized at 60° C. (140° F.) for twenty minutes. While epidemics caused by infected milk may occur only at rare intervals, any possible means of protection seems justifiable. Sanitary inspection has greatly improved the milk supply, but under present conditions its scope is limited by the magnitude of the problem. The aim of sanitary supervision is to improve the

* Abstract from Bulletin 126, Bureau of Animal Industry.

conditions under which milk is produced. The goal of the struggle for improved milk is the production of clean milk from tuberculin-tested herds, preferably produced by a few large dairy farms which are under the supervision of competent men, rather than on a large number of small farms. Granting, however, that ideal conditions can be ultimately reached, we are nevertheless confronted by entirely different conditions at the present time. Certified milk is produced in relatively small amounts in this country, and its cost of production makes its price prohibitive for a large majority of people. A good grade of clean milk may be furnished to a city where the consumption of milk is small enough to allow constant inspection of the dairy farms supplying the city. With large cities the problem is different. For example, take the case of New York, where the milk supply comes from approximately 35,000 farms located in six different States and is shipped from about 700 dairies. With milk coming from such a large area, constant sanitary supervision is an immense problem. In such a case the general conditions on the farms may be improved, but to expect in the immediate future to have all the milk come from tuberculin-tested cows and to have inspection of the farms efficient enough to prevent the possibility of typhoid infection is beyond reason.

The frequency of tubercle bacilli in market milk is well known. Anderson in an examination of market milk in Washington, D. C., has shown that milk from approximately 11 per cent. of the dairies examined contained tubercle bacilli virulent for guinea-pigs. Examinations even of certified milk sometimes show the presence of the tubercle bacillus.

The number of epidemics of typhoid fever traced to milk is striking. Schüder collected from the literature statistics of 650 typhoid epidemics, the supposed cause of which had been reported. Of these 462 were reported as spread by water, 110 by milk, and 78 by other agents. Lumsden gives figures showing the theoretical number of typhoid cases in Washington during one year which may be expected to be caused by infected milk. According to his figures 1,000 farms supply Washington, and by estimating seven persons living at each farm and considering that in the United States every year about one in every 300 persons has typhoid fever, then some 25 cases per year may be expected to occur on dairy farms supplying the city.

It is easy to see how typhoid on farms may be readily conveyed by means of milk to the city, where epidemics may result. Even with sanitary supervision of the farms it is hard and practically impossible to prevent occasional infection of the milk. Frequently cases of typhoid fever are not recognized up to the second or third week of illness, until which time no precautions are taken. In many instances mild cases are unattended by a physician and even in some cases may not be recognized. Persons who have recovered from the disease but who are still discharging typhoid bacilli in their stools and urine may directly infect the milk while handling it.

The *rôle* of typhoid carriers in the spread of the disease in

relation to the infection of milk is attracting attention. Albert has shown that about 75 per cent. of all carriers are women, and that, almost without exception, the carriers have been employed in some occupation, as baker, cook, or handler of milk, which has enabled them to transmit typhoid bacilli to substances used as food by others. He says that in some cases carriers had typhoid but a short time previous, and in other cases as long as ten, thirty, and even fifty-two years. He estimates that one in every 500 adults is a chronic carrier, while it has been estimated that there are about one-half as many carriers in a community as there are cases of typhoid fever. It is evident that to guard against chances of typhoid infection from an inspected dairy it may be necessary to have a medical examination of the dairymen.

Numerous cases of epidemics of diphtheria and scarlet fever, as well as more obscure diseases, have been traced to milk. In this connection Freeman states: "Diphtheria has apparently been spread by the best of our milk supplies. What protection have we against this in any raw milk? Virulent diphtheria bacilli exist in the throats of many healthy persons, and, though in our best dairies we have some medical supervision, no supervision could be practically enforced that would protect the milk from a beginning diphtheria or a healthy diphtheria bacillus carrier."

The numbers of bacteria in milk are of great importance in relation to intestinal diseases in children. The establishment of pasteurizing plants by Straus in various cities, where pasteurized milk is supplied to children of the poor, who are ordinarily compelled to use a dirty milk high in bacteria, as well as the use of commercially pasteurized milk, has done much to lower the infantile death rate. It seems to be the number of bacteria rather than the species which are concerned. Park says: "After five years of effort to discover some relation between special varieties of bacteria found in milk and the health of children the conclusion has been reached that neither through animal tests nor the isolation from the milk of sick infants have we been able to establish such a relation.

Kenwood believes that the pasteurization of the public supply affords a readily available means of bringing about a reduction of infantile sickness, even if the maximum is conceded to those who discredit it. Lederle in stating the advantages of pasteurized milk states: "The great benefits derived from its use in infant feeding in hospitals, infant-milk depôts, and in private practice will be attested by most physicians."

The destruction of a large percentage of the bacteria during pasteurization results in an improved keeping quality, which is of importance from a commercial as well as a hygienic point of view.

The principal advantages of pasteurization may be summarized as follows:—

(1) Protection from infection with the diseases usually transmitted by milk.

(2) Reduction of bacteria and, as a consequence, of the infantile death rate.

(3) The enhancing of the keeping quality of the milk.

It might seem that the advantages of pasteurization mentioned in the preceding pages were of sufficient value to advocate its general application. Many authorities, however, do not favour pasteurization. Some of the objections may be considered next.

Objections to Pasteurization.—One of the most serious objections to pasteurized milk is that it is believed to putrefy rather than sour, due to the destruction of lactic-acid bacteria which produce acid in raw milk. The destruction of the acid bacteria is believed to result in the unhindered growth of undesired organisms which may form toxins or other poisonous products, thus making the milk unfit for human consumption, especially in the case of young infants. This view dates back to the investigations of Flügge, whose work on pasteurized milk heated to 70° C. (158° F.) for thirty minutes demonstrated the presence of spore-forming, peptonizing bacteria which developed in the milk and formed highly toxic substances. Weber, however, found only three of these types of bacteria during an examination of 150 samples of commercial sterilized milk. Farrington and Russell state that in numerous experiments they have found the thermal death point of the lactic-acid bacteria to be in the neighbourhood of 57.2 to 60° C. (135 to 140° F.) where the exposure was for ten minutes. Russell and Hastings state, in their book on Agricultural Bacteriology, that: "The lactic bacteria do not form spores, and hence are easily killed if milk is heated. If milk is pasteurized and subsequently kept free from lactic bacteria, it will not sour, but will putrefy, due to the development of the spores not killed by the heating. Often the first sign of spoiling in pasteurized milk is the appearance of a bitter or other undesirable taste. Frequently it does not curdle for a long time. One of the dangers in the use of pasteurized milk is the fact that the consumer has no way of telling how old it is. It may appear normal in every way and yet be harmful to the health."

Revis, in a discussion of a paper by Kenwood, makes the statement that raw milk never putrefies, pasteurized milk always does. Lederle believes that with the destruction of the ordinary lactic-acid bacteria, which constitute the danger signal of old milk, the souring process is interfered with, and that more serious changes may take place without the knowledge of the consumer. Freudenreich points out the danger of allowing pasteurized milk to stand at high temperatures, due to the growth of spores of the hay and potato bacillus which are not killed during pasteurization. Jensen considers that the use of temperatures suitable to kill *Bacillus tuberculosis* destroys also the lactic-acid bacteria, which, under normal conditions in raw milk, prevent undesirable fermentations. In consequence the commercially pasteurized milk becomes more dangerous than raw milk. He believes that the degree of acidity of raw milk indicates its freshness, while the most dangerous alterations in pasteurized milk often are not visible macroscopically and escape those who control its consumption.

Rickards states: "Pasteurized milk seems to keep longer, but eventually acquires a strong odour, and really may be said to

decompose rather than sour. In nearly every instance we found that pasteurized milk, even when heavily loaded with bacteria, did not decompose until after the non-pasteurized milk taken at the same time had curdled. That such milk is unfit for food, especially for babies, goes without saying.

In connection with this objection to pasteurization Dr. Harrington, in a discussion of a paper by Rotch, states: "Again, it will make possible the carrying along of milk until, although not sour, it may become more or less poisonous. I believe that dirty milk should be allowed to stay dirty, so that it will sour more quickly, rather than that the lactic-acid ferments shall be destroyed and the commercial life of the milk be prolonged, thus permitting those organisms which are not affected by heat and which are believed to elaborate toxic substances to go on making the milk dangerous."

Another objection to pasteurization is brought out by Pennington and McClintock, who ask this question: "When milk before pasteurization shows a count of over 1,000,000, is it desirable to permit in a food the toxins and products of metabolism of these many generations of organisms, even though they themselves may be reduced to a very few hundred thousand at the expense frequently of milk enzymes and probably other substances closely connected with its food value and keeping qualities?"

Rotch expresses the same sentiment when he says: "It is a fact that certain organisms are killed by pasteurization, but we cannot kill the toxins of these organisms by heat. Simply pasteurizing or sterilizing will still allow the milk to contain elements which are exceedingly dangerous to those who drink it, and especially where young infants are concerned."

Rotch further states that the improper methods of heating now in vogue preserve the milk only some five or six hours longer than the normal raw milk, and that the commercially pasteurized milk after it has turned sour seems to be in a great deal worse condition than when natural souring took place. It may be noted, however, that his views are based on clinical observations rather than experimental data.

Some object to pasteurized milk on account of the careless methods of handling after pasteurization. Pennington and McClintock believe that from the quantitative count alone it would scarcely seem worth while to pasteurize milk of fair quality, since the contamination acquired in bottling is very often sufficient to over-balance the original germ content of the milk. They found that in commercial pasteurizing plants very low counts could be obtained from milk in the heating coils but that it was contaminated in the cooling and bottling, so that sometimes the final count was higher than that of the original milk.

It is greatly feared by some that the adoption of pasteurization will interfere with the extension of sanitary supervision. This opinion is well expressed in the discussion of Rotch's paper by Harrington, who says: "Pasteurization will put back improvements on the source of the supply and will encourage dirty habits, the farmer understanding that it is not necessary to be so

particular since the dirt that gets in is going to be cooked and made harmless."

Another serious objection is that unscrupulous dealers may repasteurize their milk or pasteurize an old milk which ordinarily would not be marketable. It is safe to say, however, that such cases are exceptional. It is often stated also that bacteria increase more rapidly in pasteurized milk than in raw milk, and considering the possibility of infections as shown by Pennington and McClintock the more rapid growth presents a serious objection to pasteurized milk. St. John and Pennington have shown in a few experiments that a more rapid increase in bacterial growth takes place in pasteurized reinfected milk than in raw milk. Their conclusions are based on the ratio of increase. Rickards working on commercially pasteurized milk concludes that on the average bacteria will increase four times as fast in pasteurized milk as in raw milk when kept for twenty-four hours at the temperature of the ice box. His conclusions are drawn from the following table and are based on the ratio of bacterial increase:—

	Unpasteurized milk, average count.	Pasteurized milk, average count.	Number of samples.
First day	1,087,000	44,000	87
After 24 hours in ice box ...	22,617,000	3,691,000	... ...
Per cent increase	2,100	8,400	... ...
Ratio	1	4	... ...

The change in the chemical constituents of milk produced by heat is sometimes the basis of objection to pasteurized milk. Chemical investigations have shown that high temperatures do produce changes in the composition of milk, but the question of the action of lower temperatures for a long period of heating, such as is employed in the "holder" process, is one which demands further study.

As to the effect of feeding heated milk to children, here again authorities are divided. Some believe that malnutrition can often be attributed to the use of pasteurized milk and that rickets and scurvy result from its use. Most authorities, however, agree that pasteurized milk is not injurious, at least as far as the chemical changes produced by heating are concerned.

The objections to pasteurization which are generally accepted as being well founded may be summarized as follows:—

(1) It is believed that the lactic-acid bacteria in raw milk, which eventually sour the milk, exert a restraining influence on the peptonizing bacteria, which would otherwise cause the putrefaction of the milk. In other words, when milk is pasteurized and subsequently kept free from lactic-acid bacteria, which are easily killed by heat, it will not sour but will putrefy, due to the development of peptonizing bacteria, the spores of which are not destroyed during pasteurization. The peptonizing bacteria, when freed from the restraining influence of the lactic-acid organisms,

may increase to large numbers and produce toxins and poisonous decomposition products.

(2) The pasteurization of dirty milk, while reducing the bacterial numbers, does not destroy the toxins or other products of bacterial growth.

(3) Careless methods of handling after pasteurization may result in serious contamination of the milk.

(4) Pasteurization may be used simply to cover up dirty milk; it may encourage dirty methods in production and retard the extension of sanitary supervision.

(5) Milk which has not been sold may be pasteurized, or even repasteurized, and its faults hidden.

(6) Bacteria may increase more rapidly in pasteurized milk than in raw milk.

(7) Undesirable changes may be produced by heating which result in making the milk less digestible, particularly in the case of infants.

It will be seen from the foregoing that much is to be said on both sides of the question, and that further investigation is required, which must be sufficiently thorough and deep so that the conclusions arrived at may be generally accepted.

Object of this Investigation.

The general object of this work has been to study the bacterial flora of commercially pasteurized and raw market milk. The term "commercially pasteurized" signifies all kinds of such milk and is not intended to indicate the "flash" process, which is distinguished in some cities from perfectly pasteurized milk (meaning that pasteurized by the "holder" process). The endeavour has been made to study the bacteria in the two kinds of milk, pasteurized and raw, when fresh and on each succeeding day as long as the milk was fit for consumption. The special objects have been to determine to what extent the lactic-acid bacteria were destroyed, and to what extent the peptonizing bacteria developed, and to compare the development of various groups of bacteria in pasteurized and raw milk.

Summary and Conclusions.

The results in this paper hold only for commercially pasteurized milk. By commercial pasteurization is meant milk heated from 60° C. (140° F.) to 65.6° C. (150° F.) in the "holder" process, or up to 71.1° C. (160° F.) in the "flash" process. At the present time the tendency is to use low temperatures with the "holder" process, and in commercial work it is doubtful if temperatures will ever be used universally in either process higher than those above mentioned. When higher temperatures are used the cream line is liable to be destroyed, a cooked taste may be produced which injures the sale of the milk, and the cost of pasteurization is increased by the use of more steam. It is not reasonable, therefore, to expect the use of high temperatures in commercial pasteurization. Arbitrary limits could be set, as 60° C.

(140° F.) to 62.8° C. (145° F.) and even perhaps to 65.6° C. (150° F.) for the "holder" process and 71.1° C. (160° F.) to 73.9° C. (165° F.) for the "flash" process, at which temperatures milk when heated under commercial conditions may be expected eventually to sour, and the bacterial content will be comparable to the average group curves for pasteurized milk as shown in this paper. If higher temperatures are used a degree of heat may be reached which will result in the destruction of all but spores, which, when allowed to develop, will undoubtedly produce peptonization of the milk. Granting that 60° C. (140° F.) for twenty minutes is sufficient to destroy pathogenic organisms, it is believed it would nevertheless be advisable in commercial work to use a temperature a little higher, as 62.8° C. (145° F.) and for thirty minutes. That temperature would be sufficiently high to afford protection against pathogenic bacteria and yet would probably leave in the milk the maximum proportion of lactic-acid bacteria, and the group proportions would be very similar to those of all grades of market milk.

Conclusions.—(1) Commercially pasteurized milk always sours, because of the development of lactic-acid bacteria which on account of their high thermal death point survive pasteurization, and perhaps in some cases because of subsequent infection with acid-forming bacteria during cooling and bottling.

The acid development in an efficiently pasteurized milk is about the same as that in a clean raw milk. But sometimes a strong, old taste develops which is probably due to the development of alkali or inert bacteria. The old taste, however, is not characteristic of pasteurized milk, for it may be noticed as well in clean raw milk when held under similar conditions. The less efficient the pasteurizing process the more closely does the acid increase of the heated milk approach that of a dirty raw milk.

(2) The relative proportion of the groups of peptonizing, lactic acid, and alkali or inert bacteria is approximately the same in efficiently pasteurized milk as it is in clean raw milk. In both cases the alkali or inert forms constitute the largest group, the lactic-acid bacteria next, while the peptonizers are in the minority. When both of these milks—the efficiently pasteurized and clean raw milk—are held, the group relations change; but if the changes which take place are compared it will be found that they are the same in each. At the time of souring, the group proportions have changed so that the lactic-acid bacteria constitute the largest group with the alkali or inert forms next in order and the peptonizers in the smallest proportion as initially. In both of these milks the group of peptonizers may increase slightly in its proportion to the other two groups during the first two days, but it then gradually decreases and always forms the smallest group.

When milk is less efficiently pasteurized the position of the groups may be reversed so that the lactic-acid bacteria constitute the largest group with the alkali or inert forms next in order, but here again the peptonizers form the smallest proportion of the total bacteria. This group arrangement is the same in a dirty raw milk.

The more efficient the pasteurization, the smaller the percentage of lactic-acid bacteria; and, similarly, the cleaner the raw milk, the smaller the percentage of lactic-acid bacteria.

(3) The peptonizing bacteria are present in smaller numbers in the inferior grades of commercially pasteurized milk during the first twenty-four hours after receiving than in raw milk of the same quality, and the peptonizers may increase to slightly higher numbers in the pasteurized milk when held several days than in the raw milk of high initial lactic-acid bacteria content; but it should be remembered in this connection that milk is usually consumed within twenty-four hours after delivery. The number of peptonizers in a good grade of commercial pasteurized milk on the initial count and on succeeding days is approximately the same as in a clean raw milk when held under similar temperature conditions.

(4) Lactic-acid bacteria of high thermal death point are found in milk and may be easily isolated by special methods of procedure. From these experiments it was found that when milk is heated for thirty minutes at 60° C. (140° F.) and plated, the percentage of acid-forming organisms that resisted the heating ranged from 0.001 to 18.91, the average being 4.8 per cent. of the total acid colonies. When heated at 65.6° C. (150° F.) the range is from 0.001 to 3.13 per cent., the average being 0.74 per cent. of the total bacteria. It must be remembered that these figures are based upon acid colonies, and these are not necessarily all true lactic-acid bacteria.

The thermal death point of one lactic-acid organism which was isolated from milk is 74.4° C. (166° F.) in broth and 75.6° C. (168° F.) in milk when heated in Sternberg bulbs for thirty minutes. When heated for ten minutes in milk the thermal death point is 77.8° C. (172° F.).

These heat-resisting lactic-acid bacteria play an important part in pasteurized milk and undoubtedly account to a large extent for its ultimate souring.

(5) All milk, whether pasteurized or raw, must necessarily be infected during cooling and bottling by bacteria in the receiving tanks, in the pipes, on the cooler, and in the bottles; but the low bacterial counts obtained from pasteurized milk in these investigations show that the reinfection must have been very small.

(6) It is manifestly unfair to conclude that bacteria increase faster in pasteurized than in raw milk, simply from a comparison of the ratios of bacterial increase. If a pasteurized milk with a low initial count is compared with a raw milk of high bacterial content then the ratios of increase may show that the bacteria in the heated milk do increase faster; but if the same pasteurized milk is compared with a clean raw milk with a low count, then the ratios of increase will be found to be approximately the same. From the results of this investigation it is evident that bacterial increase in an efficiently pasteurized and a clean raw milk is about the same when the samples of milk are held under similar temperature conditions. This question of the relative growth of bacteria in raw and pasteurized milk can be properly settled only

by a long series of comparisons of samples of milk with approximately the same bacterial count and similar bacterial group percentages.

(7) The "holder" process of pasteurization is superior to the "flash" process. With the "holder" process a high efficiency may be obtained with a low temperature, while to obtain the same efficiency with the "flash" process a high temperature would be required. A temperature of 62.8° C. (145° F.) for thirty minutes seems best adapted for efficient pasteurization.

(8) Considering the low counts of bottled commercially pasteurized milk and the similarity of the bacterial group proportions to those of clean raw milk, the former cannot be classed from a bacteriological point of view as inferior to commercial raw milk. Pasteurized and raw milk should, however, always be bottled and should not be allowed to be sold as "loose" milk from stores.

(9) Pasteurization should always be under the control of competent men who understand the scientific side of the problem. It is believed that ignorance of fundamental bacteriological facts often accounts for inefficient results rather than a wilful lack of care on the part of the dairyman.

Reviews.

MORPHOLOGY OF THE VERMIFORM APPENDIX.

By WALTER STAPLEY, M.D., D.V.Sc., M.R.C.V.S., and L. C. LEWIS, B.V.Sc.

(*Proc. Roy. Soc. Vict.*, vol. xxiii, Pt. II, pp. 342-357.)

This paper, which is well illustrated, represents research work done in the anatomy department of the Melbourne University Veterinary School, and shows the importance of veterinary training in the comparative study of anatomical structure, even from the human point of view, filling as it does the gap between the work of the general biologist and the purely human anatomist.

The paper bears evidence of very careful examination of the digestive tract, particularly the large bowel of a large number of animals of widely different genera.

The statement by Chalmers Mitchell that the rabbit has a "vermiform" appendix is attacked and discredited, because although the free extremity has a narrow lumen due to the abundant lymphoid tissue present, the appendix, if it may be so termed, is not in appearance vermiform; and, further, because the authors deny that lymphoid tissue has any connection with the form of the human appendix.

As is well known, the original theory that the human appendix is vestigial in origin has been abandoned during recent years in many quarters, chiefly owing to the work of Ellenberger and of Berry, who consider it a development, a part "specialized for

lymphoid function and not a vestigial remnant" (Berry). S. and L. state, however, that "lymphoid tissue should be regarded from many points of view before it can be accepted as the cause of the appendix," for "a mass of round cells must assume the shape their containing tissues determine." In support of their opposition to the new theory and support of the old, they cite the cæcum of the cat, which has "as much or about as much lymphoid tissue" as the human appendix, and the pig's intestine, which has a Peyer's patch about 6 ft. long, neither of which masses have induced the formation of anything approaching an appendix, and especially the "Wombat," which has a true appendix, vermiform in shape, therefore analogous in every way to the human, with the important exception that it contains no more lymphoid tissue than is present elsewhere in the intestines of that marsupial.

As to the shape of the appendix in man and in the wombat, S. and L. consider this "depends on the muscular wall of the cæcum, the outstanding cause being the external longitudinal muscle coat, arranged in bands over what is regarded as the cæcum, and in a sheath or sac over that part of the cæcum which is called the vermiform appendix." This theory of causation is worked out in considerable detail, and which is illustrated by many photographs of different cæca, such as man, including Treves' four types of appendix, rabbit, cat, baboon, lemur, Tasmanian devil, koala, common wombat, and Flinder's Island wombat (for many years believed extinct), besides photomicrographs of sections of human appendix, kitten's cæcum, wombat's appendix, and wombat's cæcum.

The treatise bears evidence of very great work and clear reasoning, but we think it suffers greatly from an endeavour to compress the matter into too limited a space; indeed, it has apparently been penned more from the standpoint of a criticism of present-day beliefs, than the record of new and valuable observations, but that we hope may follow in more detail later on.

Miscellaneous.

ROYAL COLLEGE OF VETERINARY SURGEONS.

Fellowship Degree.

A meeting of the Board of Examiners for this Degree was held at the College, 10, Red Lion Square, W.C., on Saturday, May 13. The following is a list of the successful candidates, together with the title of their respective theses:

Mr. D. C. Matheson, "Notes on the Organ-Incidence of Neoplasmata in Domesticated Animals."

Mr. W. Jackson Young, "Anthrax."

Mr. A. W. Noel Pillers, "Some Seldom Recorded Parasitic Conditions."

Captain F. C. O'Rorke, "Rinderpest (Cattle Plague), especially as met with in India."

Mr. A. C. Duncan, "Immunity."
Mr. W. Hepburn, "Anthrax."
T. Eaton Jones, "The Control and Management of a Municipal Stud."
Mr. A. Walker, "Anthrax."

The Examiners were Messrs. J. Malcolm, W. Hunting, Professor Macqueen, Mr. Sidney Villar being in the chair.

FRED. BULLOCK, *Secretary.*

ROYAL COLLEGE OF VETERINARY SURGEONS.

EXAMINATIONS IN SCOTLAND.

At a meeting of the Board of Examiners held in Edinburgh and Glasgow on May 12 for the Written, and on May 16, 17 and 18 for the Oral and Practical Examinations—

Edinburgh College.

The following gentlemen passed their Final Examination :—

Mr. L. A. Auchterlonie
,, J. B. Isle
,, W. J. E. Mackenzie
,, P. B. Riley
,, W. Halstead
,, R. Wooff
Mr. D. A. Hosford
,, C. Masson
,, R. E. Murison
,, H. L. Torrance
,, W. D. Connochie

The following passed their Third Examination :—

Mr. A. J. R. Bott
,, W. Kearney
,, W. W. Peggie
Mr. S. Littler *
,, J. McAfee

The following passed their Second Examination :—

Mr. J. B. Russell
,, G. Atkinson *
,, J. W. Hayes
Mr. R. S. Little
,, D. Starkey

The following passed their First Examination :—

Mr. R. L. Creery
,, A. D. Sanderson
,, J. E. Syme *
,, R. E. Bond *
,, N. Brear
,, T. Dalling *
,, Mr. J. Hatrick
,, D. M. Ireland
,, G. C. Lancaster
Mr. D. Marshall *
,, T. M. Mitchell
,, J. J. Plunkett
,, R. Simpson
,, B. van der Vijver
,, P. W. Walker
,, R. J. Forrest
,, J. B. Mackie

Marked * passed with Second Class Honours.

Liverpool College.

The following gentleman passed his Final Examination :—

Mr. H. L. Sowerby

Glasgow College.

The following gentlemen passed their Final Examination :—

Mr. P. Meikle
,, J. Cunningham
Mr. H. M. Johnston

The following passed their Third Examination :—

Mr. R. M. Lawson	Mr. T. Menzies *
,, A. S. Ferguson	,, D. Keir +
,, J. L. Taylor	

The following passed their Second Examination :—

Mr. E. F. Angler	Mr. T. T. Taylor
,, Mr. J. M. Dawson	,, Q. A. Stewart

The following passed their First Examination :—

Mr. E. E. McLachlan *	Mr. T. M. Timoney
,, W. Watt	

Marked thus † passed with First Class Honours.
Marked thus * passed with Second Class Honours.

Dublin College.

The following passed their Third Examination :—

Mr. T. H. Kellett	Mr. R. Burris

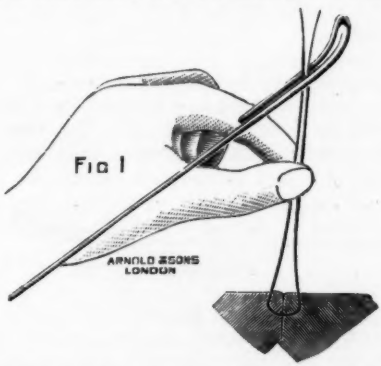
New Instruments.

MEADOWS' SUTURE AND LIGATURE KNOTTER. PATENT 1396/10.

By D. MEADOWS, M.R.C.V.S.

This instrument is specially designed for the purpose of knotting sutures and ligatures in positions difficult or impossible to reach with the unaided hand. It also does away with tangling

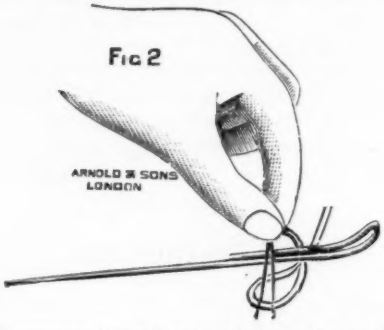
amongst the ends of a series of sutures during tying. It can also be used as a blunt or sharp probe, a director, or a ligature carrier. The knot tied is absolutely secure, and is the smallest and neatest



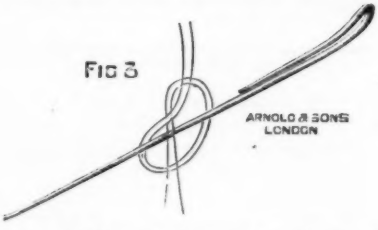
possible and cannot slip loose during the process of tying (as often happens with hand-tied knots). With a little practice the knots can be tied very quickly and neatly.

The instrument is very useful for tying deep ligatures or buried sutures.

To tie knots with this instrument, the ends of the suture are picked up and held between the thumb and finger of one hand, and pulled in between the arms of the instrument, to near the bend. The thumb and finger then let go the ends of the suture, and take hold of it below the instrument (fig. 1). The instrument



is then moved downwards and around, forming a simple loop with the thread, and then moved around the part of thread below the thumb and finger and back through the loop already formed (fig. 2). The instrument is then pulled or pushed on till the ends



of the thread come out from between the arms, the hand holding the instrument changing its hold at a convenient time, leaving the knot formed around the long arm (fig. 3). The thumb and finger then let go their present hold, and again take hold of the ends

of the thread. The knot is then passed downwards, by a pulling or rolling motion of the instrument pulling against the finger and thumb, till the suture or ligature is sufficiently tight (fig. 4), and then the instrument is withdrawn, leaving the knot completed and in place.

The instrument is manufactured in a variety of sizes and forms by Messrs. Arnold and Sons, Giltspur Street, London, E.C.

Translations.

ASEPTIC NECROSIS IN THE PEDAL BONE.

By Veterinary-Surgeon HENRICHSEN.

Aachen.

A horse on a coaching tour fell lame on the near fore-leg without visible cause. It put its toe to the ground, but placed no weight on the limb. Pulsation at the shin bone was greatly increased and over the middle of the external cartilage there was a well-defined, little-sensitive, hard swelling. It plainly bulged out the normal level of the skin. This swelling was free from fistulous openings or cicatrix and only caused œdema, and after treatment, such as fomenting, counter-irritating, and thinning of the hoof, it had disappeared. The horse was cast on the right side and narcotized; the hair over the whole cartilage was shaved, and Esmarch's bandage applied. At the most prominent part of the swelling a soft place was felt. A hollow probe was introduced deeply into the tissue, but only a little blood came away. Bayer's quittor operation was then performed. The semicircular cut through the horn wall was limited to the boundary of the swelling, and was only taken a little above the middle of the horn wall; the laps in the skin were dissected free, and the exposed part of the cartilage removed without any diseased tissue being noticed, but a completely isolated piece of bone as large as a walnut could be seen in the middle of the cartilage. After the piece of cartilage had been removed a yellowish coloured sequestrum of bone was taken away with the forceps and proved to be part of the upper edge of the pedal bone. The piece of bone was 1 cm. long and 1 mm. broad, and lay in a hollow in the os pedis, surrounded by dirty yellow tissue. No pus was encountered, but a clear yellow serous fluid, which had infiltrated into the connective tissue and bone. The diseased place was scraped with the curette and the shoeing knife. There was a rather large hole left in the bone, which appeared surrounded by decay, as well as the whole infiltrated part. A small piece of skin was snipped out at the lower angle of the wound and the skin laps sutured, then a strip of iodoform gauze was put over the wound and an antiseptic pressure bandage put round the foot.

The horse was allowed to rise and led into the stall. In the course of a few days the horse began to stand on the limb, but the bandage was kept on for twelve days. When it was taken off the wound had healed, new horn had grown and only the place where the skin was snipped out remained unhealed. In eight days the horse was at work in the field with a light bandage on, and a few days after he went to work on the streets again. He showed slight lameness at first, but this soon went away, and four weeks after the operation he was used for his usual work.

(*Deutsche Tierärztliche Wochenschrift.*)

FOREIGN BODY OF THE RETICULUM AND LUNG.

By L. LEPLAT, Veterinary Surgeon.
Roubaix.

A Dutch cow, about eight years old, was sent to be slaughtered. She was in fairly good condition and only showed a little respiratory trouble—breathlessness. On opening the carcase there was adhesion between the lung, the diaphragm, and the reticulum, these organs being united like a spitted kidney by an umbrella handle. In the reticulum there was present only a few centimetres of metallic tubing, arrested by the washer, which serves to fix the wires or whale-bones; all the remainder was lodged in the lung in the middle of a gangrenous focus, filled with liquid giving off a very disagreeable odour; for the rest the lungs seemed healthy and quite capable of free respiration.

I may add that the cow seemed not to suffer from the foreign body. She was fat and gave good meat of second quality.

(*Recueil de Médecine Vétérinaire.*)

CHRONIC PROLAPSE OF THE UTERUS AND BLADDER IN THE BITCH AND ITS CURE.

By Professor UDRISKI.

During the autumn of 1910, a confrère at Galatz sent us a three-year-old French setter bitch belonging to Madame M. B. The animal was placed in the surgical section of the School for a chronic prolapse of the uterus, existing some weeks, and which had been treated in different ways by local confrères.

On September 30, the day of entrance, the bitch presented a tumour the size of about two fists, suspended between the lips of the vulva. The tumour was red with violet folds and soiled slightly by the dejections; the mucosa was detached in certain places; in its centre it showed an opening which was no other than the neck of the uterus; on one side of it there was a small orifice by which a yellowish liquid, having an odour of urine, escaped in drops. The sound was introduced into this orifice and curved itself round into the bladder, which was itself comprised in the hernial contents. We thus diagnosed prolapse of the uterus, complicated with that of the bladder. Reduction was easily made, but recurrence immediately followed.

After preparation of the organ it was returned and sutured with a semicircular suture in such a way that urine could escape at its lower part.

The suturing did not succeed, for the patient pulled out all the points with her teeth, in spite of every precaution taken to maintain them.

A bandage made out of a piece of skin with a hole in, through

which the lips of the vulva protruded, was then made and kept on for two days, but this was pulled off.

After these trials we had recourse to hysteropexia. During this period the condition of the animal got worse; she was very thin, and ate badly, and gangrenous patches developed in the uterus.

Previous to operating, the animal had been submitted to an absolute diet for twenty-four hours. She was chloroformed and laparotomy performed in the middle line. It was seen that the uterine coruna were very much distended. The organ was then reduced after previous catheterization of the bladder and drawing off a good quantity of urine.

The right uterine horn was then fixed to one side of the abdominal wall with catgut, the other was attached to the body of the uterus, exercising light traction upwards and anteriorly. The suture in the abdominal wall involved the peritoneum and abdominal muscles; in the genital organs the serosa and muscularis were transfixed without penetrating the internal cavity. The abdominal wound was closed with three rows of sutures; one peritoneal another musculo-aponeurotic; both of catgut; the third cutaneous with silk.

The wound was sealed with sublimated collodion and a bandage applied. Milk diet was recommended. The result of the operation was very satisfactory. There was no fever, the animal was lively and had a good appetite. During some days boricated solutions were injected into the vagina.

We awaited a complete cure, but after some days we observed that a small tumour, the size of a nut, had made its appearance between the lips of the vulva. The laparotomy wound had healed per primam and the tumour was only half its previous size, viz., 5 cm. in antero-posterior diameter, whereas formerly it was 12 cm. A fresh laparotomy was performed at the old site and it was found that adhesion had taken place at the previous points of suture. It was now resolved to fix the bladder to the abdominal wall. Between the abdominal wall and the genital organs certain little pedicles were found which being distended did not permit of normal connections between the genital organs.

This time the depths of the vagina were fixed to the abdominal wall by a suture in the form of a cross. This suturing was made easy by vaginal support given during the whole of the operation. The anterior part of the bladder was fixed to the abdominal wall by a suture. Thus a *cysto-vagina-hysteropexia* was performed. The operation at an end the previous after-precautions were taken. No return of the prolapse has occurred and the operation has been completely successful.

Cadiot, in his clinical lesson on two cases of prolapse of the uterus, says: "Tampering of the deep part of the vagina, which was done in these two cases, is the treatment of choice in prolapse of the womb in the bitch. Since 1896 this has always been done here. We have not had to practise amputation." We consider Cadiot has been very fortunate in his cases.

L. Auger, in the *Journal of Veterinary Medicine and Zoo-*

technny, August 31, 1910, reports three cases of retroflexion of the bladder treated by cystopexia in the bitch. Commenting on this, Auger says: "In the three cases I report cystopexia has been effective, and that is why, in my opinion, it is the treatment for choice."

I am entirely of M. Auger's opinion.

(*Arhiva Veterinara.*)

HÆMOGLOBINURIA OF THE HORSE AND ITS TREATMENT.

By M. V. DROUIN.

Alfort.

An index as to the obscurity of a problem is furnished by the abundance of publications concerning it. There are few subjects that have provoked so many articles or so much controversy as paraplegic hœmoglobinuria in the horse.

Professor Arloing held that it is a primitive affection of muscle, *a toxic myositis*. It gives the appearance of paralysis followed by functional impotence of the muscles of sustentation. It is accompanied by ejection through the urinary tract of muscular methemoglobin, which alters the kidney in its passage, determining uræmia and secondary lesions of the different parenchymas.

The histological lesions of hæmoglobinuric muscle have been well studied. The intoxicated muscle takes on a salmon colour and loses all tonicity; it tears under the least effort and rupture of the psoas or triceps muscle is one of the worst complications that arises through being obliged to drag a horse when he has fallen.

Diagnosis is not hard, but in those cases, due to location in the anterior muscles, the water may have cleared up and the horse got all right by the time the practitioner arrives.

There is considerable difference of opinion as to prognosis. Many practitioners call it a benign disease, others consider it the reverse. There are different reasons for these divergencies of opinion. Races vary in sensibility as well as in their surrounding conditions. If cures are more frequent in the country than town, it is because the invalids can be stopped and stabled where attacked.

Thus Lucet has not lost one case out of eighty-five.

A subject attacked must be put in a state of *absolute and immediate repose*, then one must facilitate the elimination of the toxic substance and the dissolved hæmoglobin, which is itself a poison. Carry out treatment where the horse falls if possible. Nothing seems to us worse than transport of a paraplegic in a float. Traction on the limbs ruptures the muscles and the noise of the travelling vehicle upsets the patient.

Drouin strongly advocates compresses to the loins. The effect of either heat or cold has been almost the same in his

two sets of cases. Purgation not too drastic is advocated. Emptying the bladder, too, is important.

As remedial agents, 50 to 70 grm. of bromide of sodium, 3 to 5 grm. of bromide of potassium every two hours, combined with 500 grm. of sugar every six hours, or iodide of potassium 15 to 25 grm., associated with salicylate of eserine 10 centigrammes, and 500 grm. of bicarbonate of soda four times daily, have been used successfully.

Drouin considers theobromine worthy of trial. He discountenances with reason all attempts to suspend animals incapable of standing, and characterizes such procedure as useless and dangerous.

(*Revue Générale de Médecine Vétérinaire.*)

ACARIASIS IN THE HORSE.

By Chief Veterinary-Surgeon Dr. BERGER.

During last winter I had the opportunity of seeing a case of acariasis in the horse.

Attention was called to an officer's horse whose hair had been falling out at the side of the neck and during the last three days had been increasingly shed and was accompanied by itching. I was disinclined to believe the officer's servant on this last point and attributed the loss of hair and irritation to friction from the bridle. I therefore had it covered with smooth linen and disinfected the place on the skin with 1 per cent sublimate solution. At a second examination eight days after there was no betterment or renewed growth of hair and the bald place had increased to double its original size. The assertion as to the itching was repeated and a thorough examination was made. There was now not only desquamation of the epidermis, but an intensive inflammation of the skin, with the formation of nodes the size of a millet seed and isolated pustules. The skin was thickened and showed incrustations. Microscopic examination of the shaved skin showed the presence of acarus folliculorum, also of acarus mites of the exact kind I have often seen in dog practice.

A short time previously I had attended the dog of the owner of this horse for mange. The question arose whether the servant had used the horses brush to clean the dog. My suspicion was confirmed by him. In this case the affection was conveyed from the dog to the horse by cleaning, and acariasis caused on the neck of the horse.

Literature, as far as my knowledge goes, only records conveyance of acari of the dog to man by means of the wide sebaceous glands. This observation, recorded by me, shows that dog acari can be conveyed to the horse and calls for careful examination of acarus mites on hairless places in the horse.

(*Zeitschrift für Veterinärkunde.*)

EMPLOYMENT OF IODIDE OF POTASSIUM BY FRICTION.

BY LANCELEUR.

Mode of Preparation.—Take 5 grm. of pot. iodide powder it in a mortar, add some drops of glycerine, which perfectly dissolves the iodide, and incorporate 20 grm. of mercurial ointment.

Method of Employment.—It is absolutely essential to prepare this ointment at the time of using it. If twenty-four hours old it gives no result. To rub in, clip the hair, spread the ointment with the finger and rub vigorously from three to five minutes with a very hard tampon. Twelve hours after vesicles may be seen, but there is never any itching. Slight tumefaction soon diminishes and the epidermis dies and falls off ten days after.

Indications.—The results are particularly gratifying in hæmatomas of the knee. Against tumours of the withers following pressure and friction from the harness. Three or four repeated frictions cured deep cysts. The results obtained in tendon sprains have often been better and always as good as those obtained by biniodide of mercury, firing, or insufflations of air. In these cases absence of all irritation permits renewal of the frictions every six or seven days.

(*Revue Vétérinaire Militaire.*)

Letters and Communications, &c.

Major Baldrey; Professor Duncan; Professor J. S. Jones, Mr. J. B. Buxton; Mr. W. Lothian; Mr. J. A. N. da Cunha; Mr. L. M. Douglas; Mr. E. W. Greening; Captain Nicholas; Mr. R. E. Philp; Mr. T. S. Price; Mr. R. F. Stirling; Board of Agriculture and Fisheries; Department of Agriculture and Technical Instruction for Ireland.

Books and Periodicals, &c., Received.

"Meat and Food Inspectors' Examinations" (Baillière, Tindall, and Cox); Record of Sports (Royal Insurance Company); Bulletins of the Bureau of Sleeping Sickness; Proceedings of the Royal Society of Medicine; Bureau of Animal Industry, U.S.A.; London University Gazette.

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